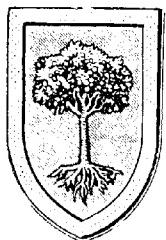




PÈRE ARMAND DAVID.

**LILY
YEAR-BOOK
1938**



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R.H.S. LILY YEAR-BOOK

1938

FOREWORD.

By F. C. STERN, F.L.S., Chairman, Lily Group.

THE Winter of 1937-38 was on the dry side, with no very cold conditions, but the Spring of this year was indeed a difficult one for the grower of Lilies. February did not live up to the proverbial name of "fill-dyke"; in fact, in most places the month of February was as dry as a bone. Then the Summer began in March with the warmest March days that have been known for many years. The Summer disappeared in April, and the Winter began again with increased severity; the cold east winds and severe frosts continued at intervals right on into May. But still no rain in the South of England. Then in June some of the worst gales ever known in that month rushed over England and Scotland to break the leaves and scorch the foliage of all the plants and trees which were beginning their growth rather late. These conditions were severe trials for every gardener, but perhaps more particularly for the Lily-grower. The weather was all topsy-turvy for Lily-growing. Lilies require ample rains when they are growing and a warm atmosphere and calm conditions when they are coming into flower. In spite of all these difficulties the Lilies shown at the Chelsea Show were better than ever before. The exhibits of Messrs. WALLACE and Messrs. CONSTABLE were very fine indeed. Messrs. CONSTABLE had some one hundred and twenty species and varieties out in flower in their stand, and Messrs. WALLACE not many less. It is very wonderful how these growers bring all these different Lilies into flower in time to be at their best at the Chelsea Show. The exhibits at the July Show were quite first class. The Lilies shown by the professional growers and by the amateurs were all discussed and described at the meeting on the afternoon of the first Show in July. All congratulations are due to Lord SWAYTHLING and his gardener, Mr. ROSE, for the wonderful condition in which he shows his Lilies at the R.H.S. Hall. His Lilies are an example of how they should be grown. The Lilies in

gardens, in spite of all the bad weather and difficulties of the season, have done on the whole well. The late frosts have been uneven in their effect. In two gardens which are quite close to each other near London the frost took a heavy toll in one garden and yet in the other there was practically no sign of damage. There has been a good deal of talk about *Lilium regale* not being so good as usual and deteriorating. I have been to a good many gardens in the South of England this July and find *L. regale* flowering just as well as usual; the only deterioration is that in some places they are not so tall as usual, which is no doubt due to the lack of rain in the earlier part of the Summer. Of course *L. regale* will deteriorate unless the plants are raised from the best forms. If the bulbs are bought the best forms only should be bought.

A Lily Dinner was held in the restaurant of the R.H.S. Hall and was well attended. The Rev. Prof. LYTEL opened the discussion on "the six best Lilies for the garden" with a masterly and amusing address. There was an interesting and instructive discussion, which is fully reported on p. 68.

Several meetings of the Lily Group were held during the year. They were all well attended and much useful information was given both by the openers of the discussions and by those who attended. In spite of all weather trials, Lily growers seem to be as keen as ever if their attendance at the Lily Group meetings are any guide. The Group meetings are open to all Fellows of the R.H.S. and all are welcome.

ARMAND DAVID.

1826—1900.

ALTHOUGH his portrait, which forms the frontispiece this year, may be unfamiliar Père ARMAND DAVID's name is known to every lover of good garden plants. It is commemorated in *Lilium Davidi*, *Clematis Armandi* and *Davida involucrata*, and many another of the new species which he discovered in China. Amongst his novelties were a few Lilies and a Fritillaria, but these, though of special interest to the readers of the Lily Year-Book, are but trivial details in the story of a fascinating career.

DAVID, who was born near Bayonne in 1826 and ordained a priest in 1851, was attached to the Mission of the Lazarists at Peking in 1862. During his first few years in China he collected mainly in the vicinity of that city. When his collections reached Europe they so impressed the authorities at Paris that a request was made to the Lazarist Mission that DAVID should be largely liberated from his clerical duties in order to explore other parts of China in the interests of science. The request was granted. His three great journeys into the interior were the result—viz., (1) South Mongolia in 1866, (2) Western China and Eastern Tibet in 1868–70, and (3) Central China in 1872–4. A full account of these explorations is to be found in Bretschneider's European Botanical Discoveries in China and in Fournier's Voyages et Découvertes Scientifiques des Missionaries naturalistes français (Encyclopédie Biologique x. 1932), a smaller volume but more recent and wider in scope.

DAVID was evidently a patriot as well as a naturalist and explorer. After his first journey he wrote : "Puisque les circonstances me le permettent je voudrais faire quelque chose de mieux pour notre France et ne pas abandonner aux Anglais seuls l'exploration scientifique de l'Extrême-Orient." He was more than successful. In Moupin* he was destined to reap a harvest such as has seldom if ever been equalled. He arrived in Szechwan in November, 1868, exactly six months after leaving Peking, having accomplished the journey, as was his constant practice, on foot. Early the following year he set out for Moupin, then a small independent principality of the Mantze race. It was an arduous ascent amidst snow and ice, and over a pass of 10,000 ft. high. But in Moupin (about 6,000 ft.) and on the slopes of the Hong-shan he must have been greeted in the Spring with an amazing display of floral beauty—new and beautiful Rhododendrons on every hand—*R. moupinense*, *R. oreodoxum*, *R. calophyllum*, *R. argyrophyllum*, *R. decorum*, *R. lutescens* were a sample of the new species he sent to Paris. *Clematis*

* Muping (according to English spelling), 30° 27' N, 102° 50' E.

Armandi was collected in April, and amidst strange species of Cherry, Hazel and Oak he found *Davidia involucrata*. FRANCHET worked out all this material at Paris and bestowed names on 163 new species. Most of them are described in his fine work entitled *Planta Davidianae*.

It was at Moupin also that DAVID discovered *Lilium Duchartrei* and *L. Davidi*. Excellent specimens of the former were preserved, but the type of *L. Davidi* is very poor and would probably have forever remained a mystery had not WILSON successfully elucidated it in his ardent endeavour to show that his own *L. Willmottiae* was a distinct and new species! *Fritillaria Davidi* also was collected at Moupin, likewise *Acer Davidi* and the blue-fruited *Viburnum Davidi*, together with many other species on which FRANCHET bestowed the Abbé's name. But, as FOURNIER writes : "Combien d'autres espèces, qualifiées de Davidi ou de Moupinensis!" In addition to dried material David sent home seeds of many plants, some 80 species of which were raised and cultivated in the Jardin des Plantes.

Having despatched his collections, botanical and zoological, DAVID left Szechwan in the autumn of 1869, nearly worn out with the fatigue and hardship. Owing to riots he was prevented from returning to his headquarters at Peking : hence after calling at Shanghai he left for Europe. In a little over a year he set out again on his last great journey (April, 1872), exploring on this occasion new areas in the provinces of Honan, Shansi, Shensi, Hupeh, Kiangsi, Fukien and Chekiang. Again he amassed large collections, both botanical and zoological (fig. 3). In Shensi he discovered *Pinus Armandi*, but the plants were on the whole not of such interest as those from Szechwan. He suffered much from fever and lung trouble and left China for the last time in April, 1874. His *Journal de mon troisième Voyage* gives a detailed account of this tour. After his retirement he lived mostly in Paris and his death occurred in 1900.

DAVID was an all-round naturalist, and his discoveries in the animal world were even greater than in the field of botany. He was perhaps the greatest of all French missionary explorers. Birds were always a special interest, and one of the finest of his published works is the magnificent two volumes issued in conjunction with Em. OUSTALET, entitled *Les Oiseaux de la Chine*, which dealt with over 800 species and included 124 coloured plates. His collections were mainly sent to the Paris Museum and included 10,000 entomological specimens, over 1,300 birds together with a number of nests and eggs, over 600 mammals, besides specimens of reptiles, fishes, geological material, many fossils, together with bones of Rhinoceros and other extinct mammals. A large number of plant specimens were lost, but in addition to 3,500 given to Paris he presented herbarium material to other institutions in Europe and also to the Emperor of China's private museum at Peking.

It was ARMAND DAVID who discovered and introduced the race of deer known as Milou (*Elaphurus davidianus*), which he detected in the wild or semi-wild state in the Imperial Park at Jehol, and of which he

In face p. 4

FIG. 2. *Vaccinium flansorii*.



Onthologus
J'en ai rapport qu'il adressait au Muséum
de Paris, en 1866, l'aminer au Dr Gaspard.
Ce diorama observé par moi jusqu'à cette époque
Il y avait dans ce Catalogue monsieur
Plissieu fait de Dernivalzine. Mais
ceux qui ultra longtemps y ont été placés
étaient en un état déréalisé. Mon fait
comme bon d'autre à peu près, en une
communauté de cette année 1872, les Nouvelles
Archives du Muséum des plats! Mon
Nouveau Catalogue de Diptères de l'
Asie du Sud-Est chinoise, qui comprend
470 espèces, le Ce Nombre, un grand
Nombre pour des espèces connues;
autour 160 n'étaient pas encore été
signalés par les Onthophagiens connus
faire partie de la Faune Chinoise, et
cespuis on a été privée. Comme toutes les
espèces sont très rares. De celles-ci, le Nord m'a
fourni : *Cyphomyia Davidi*, *Hypopygia duratana*,
D. Carpobroti n. sp. *Diaditimus* M. Ew., *Carp.*
Mangistus n. sp. (1866 in litteris) *Parus leucurus* C.
Röder villa sa, J. V. Oropoucheva Armande, Ma
Thopophilus petkinensis Th., *Microthrix*
David, n. sp. *Proctotrupes* les espèces nouvelles
qui j'en rapporte de la Chine Ouest (n. sp.)
Sur : *Pleurotus* n. sp., *P. bicolor* fuscus,
P. acutipennis n. sp.,

FIG. 3.—AN EXAMPLE OF PÈRE DAVID'S MANUSCRIPT.

ARMAND DAVID, 1826-1900.

was fortunate enough to secure living specimens for Paris. According to FOURNIER the deer were hunted and subsequently exterminated by German troops in the Imperial Park, and it is only through DAVID's enterprise that the species still survives in Europe. The herd of 200 which exists at Woburn to-day (1937), known as "David's Deer," are the descendants of his introduction.

A. D. C.

LILIES IN THIN WOODLAND.

By F. J. ROSE, F.R.H.S.

THAT there is much to be learned yet on the cultivation of Lilies in this country is evident from much of the literature on the subject and from the discussions of the Lily Group. There is evidence also of considerable diversity of opinion on the subject. Probably all Lily growers would agree that one cannot dogmatize as regards the requirements of this fascinating genus. It appears that the Lily prefers to be coaxed rather than scolded into growth.

I believe it has been said by one of our eminent authorities that one cannot grow more than forty species of Lilies in any one garden. Probably he is right, for such is the perversity of the Lily that two skilled men with gardens on opposite sides of a road may each find it comparatively easy to grow certain species with which the other fails.

I intend in this short article to give some of my experiences here in the South, where possibly we get more sun and where the atmosphere is drier than in many other parts of the country.

It is thought by many that in South Hampshire we live in a haven of the horticulturist's dreams, where no frosts ever come to disturb our peace of mind. This is entirely wrong, as evidenced this year of 1938 when Townhill suffered as much as any garden. Frost was registered every night, except one, from April 3 to April 21, up to 13° being recorded. On May 8 and 9, 12° and 10° respectively were experienced. Rainfall from January 1st to the end of May was 6.21 inches—total for the same period in 1937 was 27.78 inches.

It is interesting to note that the Lilies to suffer most from the frost were those that started into growth early. Several were well above ground by the end of January—*Lilium auratum*, *L. Hansonii*, *L. Martagon* hybrids, and *L. Maximowiczii*. They appeared to stand the frost well, even though the Rhododendrons, Azaleas, and other shrubs around them were badly damaged, and it was not till growth became more rapid during May that it became apparent that the flowers were destroyed and for this season the plants would be "blind."

The *L. Martagon* hybrids of which we have many, commence growth earlier than the species, and so the *L. Martagon* type and its varieties *album*, *dalmaticum* and *Cattaniæ* were unhurt whilst the flowers of the hybrids close at hand were nearly all destroyed.

Many of the more difficult species of Lilies may be grown in thin woodland, and if one is favoured with a stream through the wood his chances of success are considerably increased. Many Lilies seem particularly to like the banks of streams.

Planting Lilies amongst shrubs is often advocated, but this advice should be qualified. Often the shrubs grow so quickly that the Lilies are overgrown and starved before they are really established. A better plan is to leave an open space between the shrubs so that the latter may be kept in check. The Lilies will appreciate this consideration. Ferns form an appropriate association with many Lilies and are easily kept within bounds. *Meconopsis*, *Primulas*, and *Thalictrum dipterocarpum* are also suitable.

Here at Townhill the wood slopes to the north. This is detrimental to those species which start growth early, especially in a season like the present when the North, and North-east winds with frosts were so prevalent. But with the advancing season this aspect is a definite advantage—it is cooler, and more moist, and the flowers last longer.

A portion of our wood which suits Lilies well consists of a bank of clay with an overlay of rich humus—the accumulation of many years of decayed leaves and rubbish. Though always moist, the site is never stagnant, as the bank is fairly steep, with a permanent spring of water rising near the top. When planting, a fair quantity of grit is mixed with the soil to assist in keeping the bulbs drier during the winter months. Here we have successfully established *L. Bolanderi*, *L. Washingtonianum*, *L. rubescens*, *L. maritimum*, *L. Grayi*, *L. Humboldtii*, *L. canadense*, *L. columbianum*, *L. rubellum*, 'G. C. Creelman,' *L. Davidi macranthum*, *L. carniolicum*, and *L. × Maxwill.* Unfortunately for this disastrous season, a fierce gale was encountered during the night May 31-June 1. A huge tree was blown down from the top of the bank and some of these groups were destroyed—at least for this season.

It is unnecessary to describe these Lilies in detail and space would not permit, but special mention may be made of *L. Bolanderi* (fig. 6), that delightfully dainty Lily which grows to a height of 2ft. or more with deep red spotted flowers 5 to 7 to a stem. *L. maritimum* is also one of the dwarf gems with deep crimson semi-drooping bell-shaped flowers. Unfortunately the flowers of this species do not appear to last so long as many others. The banks of a stream provide a good home for these two Lilies.

I would describe *L. columbianum* as one of the more easily grown species. Here it is well established from seed, its dainty hanging flowers being a joy for a considerable time.

I must confess to no love for *L. carniolicum*. It is one of the very earliest to flower, of no particular beauty, and the flowers last only a very short time.

Fortunately the soil in our wood varies, and so in another part we have a border of deep loam through the middle of which a small stream trickles for about nine months of the year. *L. Brownii* was first planted here some eight or nine years ago and other groups have since been established from the original one. Associated with it are *L. Willmottiae*, *L. Wardii*, *L. amabile* and its variety *luteum*, *L. parvum*,

L. superbum, *L. canadense*, *L. Szovitsianum* (fig. 5), *L. Duchartrei*, *L. Roelzii*, and various Martagons. *L. Bakerianum* is doing well in this border for the third season.

It is well to record one's failings as well as successes. Hence, when planting this border the groups of Lilies were interspersed with dwarf late-flowering Rhododendrons—Arthur Osborne, Red Cap, *apodectum* × *Griersonianum*, Nereid, and Tally Ho—but the association was not a success. The Rhododendrons were too spreading in habit and the Lilies grew so tall that many of the Rhododendrons were almost hidden during the Summer months. Their places are now being taken by the more suitable subjects already mentioned.

L. Brownii is undoubtedly the best of the trumpet Lilies. There is a richness in the flowers which places it above all others. Most Lily enthusiasts would place *Brownii* amongst the best three species and I would concur. My first three would also include *L. canadense*. Besides being one of the most graceful, the flowers remain good longer than most species.

A word may also be said for *L. parvum*. This Californian species has been established here for six or seven years and has never failed. It is one of the last to start into growth and one of the earliest to flower, a statement which applies also to *L. rubellum* and to the Nomocharis. Here *L. parvum* reaches a height of 5ft., with as many as twenty-four orange-coloured almost upright flowers to a stem.

A species which has never been a real success in the wood is *L. Duchartrei*. It usually produces an abundance of small thin growths with from one to three flowers to a stem. I have seen with envy the comparative ease with which Mr. G. H. DALRYMPLE grows this Lily in his garden at Bartley with stems rising to 5ft. with heads of about ten flowers.

Another we have failed to establish is *L. philadelphicum*. So far it has petered out in two or three years. It is firmly established in Professor LYTTEL'S garden at Nyewoods, where it has thriven for seven or eight years.

A speciality of Townhill is *L. giganteum*. The stems of flowers towering above the Rhododendrons and other shrubs is a grand sight, and the scent reaches to the main Portswood Road some two hundred yards away. What a pity it does not last longer! The secret of success with this Lily is plenty of moisture (but not stagnant) for the roots with the bulbs at the surface and fairly dry. Being so near the surface a covering of bracken or other material is recommended during the winter. The largest stems we have had were from seedling plants. These averaged 10 ft. in height and up to 27 flowers to a stem. Plants from the subsequent off-sets have never reached that size. One is therefore led to suspect that seedlings would always produce the largest plants. Possibly the moist atmosphere from the river which flows at the base of our wood helps in the growth of this Lily.

Two Japanese species which should be tried by all who have a

woodland garden are *L. medeoloides* and *L. distichum*. *L. medeoloides*—the wheel-Lily—is here growing on a bank and is perhaps the more easy of the two. Its stems rise to $1\frac{1}{2}$ ft. to 2 ft., and carry five to seven scarlet, spotted Martagon flowers. The growth of *L. distichum* is similar, but usually it has only one whorl of leaves. The colour of the flower varies. Here it is a clear, deep yellow-spotted brown. It is a very beautiful flower.

Suitable spots are found for the dwarfer Eastern species, *L. pumilum*, *L. cernuum*, *L. concolor*, and its yellow variety 'Coridion.' *L. pumilum* is not a long-lived species, but it is easily raised from seed.

I can make no boast of *L. japonicum*—much to my regret. It has never been robust, and seldom has more than two—very rarely three—flowers to a stem. This is another species which my near neighbour, Professor LYTTEL, grows particularly well.

A group of *L. cordifolium* is doing well after several trials. At the time of writing these notes, July 13, its flowers have not yet opened. This miniature *L. giganteum* apparently prefers conditions similar to its giant cousin.

L. centifolium was planted only this year. So far it promises well.

Two hybrid Lilies of outstanding merit are 'G. C. Creelman' and 'Maxwill.' The former is a clean, healthy grower; the flowers, though similar in many respects to *L. regale*, are better formed and open some two or three weeks later. For the woodland garden it is definitely a better plant. 'Maxwill' grows from 6 ft. to 8 ft. in height, and will no doubt be largely planted in the future. Both may be classed as easy doers.

L. × Burbankii (*pardalinum* × *Parryi*) is also a very fine Lily. The form raised by Col. Napier is more robust; the flowers larger and more open than the older form.

Some of the *Cromottiae* hybrids raised by Mr. J. E. H. STOOKE have done well in this their first year, and promise well for the future.

There is definite proof that the Lilies mentioned in these notes may be successfully grown in thin woodland in this country. Doubtless there are many others. Some difficulties and uncertainties will be encountered, but additional pleasure and satisfaction will be found with the success which follows. Lilies create an interest in the woodland garden long after the Rhododendrons, Azaleas, and other flowering shrubs are over. The season of the Lily may be said to extend from May to October.

In conclusion, I may add that *L. candidum*, *L. regale*, *L. × testaceum*, *L. pomponium* and *L. chalcedonicum* are grown in borders (fig. 4), in other parts of the garden where they receive more light and air, which suits them better. To this list will be added *L. bulbiferum*, *L. bulbiferum croceum* and *L. umbellatum*.

A BEGINNER'S QUESTIONS ANSWERED.

ON page 115 of the Lily Year-book for 1937, Mr. P. A. CRAGG, a member of the Lily Group and an experienced grower of Chrysanthemums and other plants, propounded eight questions about Lilies and modestly added—" Could I get these questions resolved I might hope in time to be a Lily grower." As it seemed probable that many people besides Mr. CRAGG would like to see the questions answered in the Lily Year-book, the Editorial Committee, with the kind co-operation of Professor E. S. LYTTLE and Mr. F. J. ROSE, applied itself to the task. The answers which follow are the result, and where the expression "the Committee" occurs it means the members of the Editorial Committee together with Messrs. LYTTLE and ROSE.

Question No. 1.

FEEDING.

Should one feed or not? This seems to be in two categories: (a) for Lilies of long life; (b) for Lilies of short life. Over-feeding for section (b) would not be so expensive.

Answer.

It is understood that Mr. CRAGG's garden is on land which COBBETT would have called a "villainous, rascally heath," where the natural flora consists largely of heather, bracken and birch trees. The soil in such cases is usually light and very poor, overlying a subsoil of gravel, and where a depression occurs a layer of impervious "pan" is frequently found a short distance below the surface. On such a soil, deep cultivation is essential, and if there is a "pan" it should be thoroughly broken up, or, where possible, removed. In view of the poverty of such soils, and their liability to drought, large quantities of water-holding organic matter are essential for the successful cultivation of Lilies and, for that matter, of many other plants.

Turning to a more general consideration of "feeding," while all are agreed that care should be taken to avoid the use of too much nitrogenous manure because of the danger of producing soft growth with increased liability to disease, it is considered that the stronger-growing species benefit, especially on light or calcareous soils, from the use of organic matter, such as leaf-mould or well-rotted cow or farm-yard manure, applied to the soil well below planting level when preparing a new site. For the smaller Lilies leaf-mould is considered to be good, but farmyard or similar manures both unnecessary and undesirable. One member has found hoof pairings beneficial.

Lilies which have been long established appreciate the periodical removal of the surface soil to the level of the bulbs and its replace-

ment by a good compost, but the use of farmyard manure as a top dressing has been found to be detrimental even with such a strong grower as *L. giganteum*.

Little appears to be known regarding the effect of inorganic manures, though some members of the Committee believe that wood-ash has a beneficial effect on *L. candidum* when used as a top-dressing.

When short-lived Lilies seem about to deteriorate, replanting on a fresh site gives better results than top-dressing.

Question No. 2. DEPTH OF PLANTING.

Deep planting is a point that is emphasized by all the experts. But each one tells us that Lilies have contractile roots that will enable them to reach the right depth: why then trouble about it except to plant at such a depth that frost is excluded and the necessary moisture provided?

Answer.

It is hardly true to say that "deep planting . . . is emphasized by all the experts" because, for example, everyone agrees that *L. candidum* and *L. giganteum* should be so planted that the tops of the bulbs are only just below the surface.

The depth at which flowering-sized Lily bulbs should be planted is that at which they will be able to obtain a proper supply of water. The depth will, therefore, depend upon the kind of Lily, the nature of the soil, the rainfall, and the degree of exposure to the sun. With hardy Lilies, frost does not enter into the question, as may be seen from the fact that potted bulbs of *L. auratum* may be frozen solid during the winter without any harmful result. In the eastern United States and Canada wild bulbs are frozen in a normal winter. One member intentionally left bulbs exposed and they were "frozen to balls of ice" without ill effects. Nor do contractile roots have more than a very slight effect where adult bulbs are concerned, as the resistance which the soil offers to large bulbs cannot be overcome by the comparatively ill-developed contractile roots which adult bulbs produce. During the first season following the germination of a Lily seed the contractile roots are capable of pulling the little bulb down several inches, but subsequently, as the size of the bulb increases, the efficiency of the contractile roots decreases, so that it is a common thing to find a Lily bulb, still in its sand surround, at the same depth at which it was planted as a flowering-sized bulb several years previously.

In light soil in the New Forest *L. auratum* has been found to thrive with the bulbs 18 inches below the surface, but in the moist conditions at Logan excellent results follow shallow planting.

Question No. 3. STEM ROOTS.

From how great a length do flowering stems emit roots and to what length do they extend from the stems? Is it better to plant deeply

to allow for these roots, or should one mulch heavily? To me the latter seems the better method; it allows of fresh food being provided each year.

Answer.

Stem-rooting Lilies, under congenial soil conditions, emit roots over the whole length of the stem from the bulb to just below the surface of the soil, as many will have noticed from an examination of old stems. One member found that the stem-roots of an exceptionally robust specimen of *L. auratum* were 18 inches long, but it is thought that stem-roots are seldom longer than a foot and usually a good deal less.

A stem-rooting Lily should be planted deeper than one which does not produce roots from the stem. In order to maintain the health of the stem-roots the soil above the bulb must be kept moist during the growing period, and the best way of doing this is to apply, before the dry summer weather sets in, a mulch of rotted leaves, the material from a spent hot-bed, or the like. The object of the mulch is not to provide an additional rooting medium, but to prevent the existing rooting medium from becoming dry.

It is a good thing periodically to remove the whole or part of the soil above the bulbs during the dormant period and to replace it by fresh soil, but this practice is not a substitute for mulching, as the new soil, like the old, will be in danger of becoming dry unless a mulch is applied in the early summer.

Question No. 4. DEPTH OF PREPARED SOIL.

Is there a ratio for depth of prepared soil below the bulb to the depth of soil above? Bulbs planted 1 ft. deep presumably would require 2 ft. to 3 ft. of prepared soil under them.

Answer.

There is no fixed ratio between the desirable depth of soil above and below a Lily bulb.

The depth to which the soil below a Lily bulb should be prepared varies with the kind of Lily. For none should it be less than a foot, and though that may be adequate for small species, even they are unlikely to derive anything but good from deeper cultivation. For strong growers it is not a waste of time to prepare the soil to a depth of 2 feet (or even more) below the level at which the bulbs are to be planted.

Question No. 5.

ROOTS.

Are (Lily) roots annual? How far from the stem do they extend? This would control the width of the prepared site.

Answer.

The duration of Lily roots is a matter into which investigations are now being made and further research is needed. It is known, however,



FIG. 4.—LINES IN THE BORDER, TOWNSHILL PARK.
(P. S.)



FIG. 5.—*LILIUM SZOVITSIANUM* AT TOWNHILL PARK.
(p. 8.)

To face p. 13.

that in some Lilies at least the principal basal roots survive the first winter after their formation, and continue to act during the whole of the following growing period, but it is thought that they do not normally survive the second winter. On the other hand, stem-roots live for one growing season only.

Little is known of the length or lateral spread of Lily roots under garden conditions. On one occasion Mr. GROVE traced the roots of *L. Leichtlinii* for a distance of 38 inches from the bulb in a lateral direction, and in another instance found the roots of *L. pardalinum giganteum* at a lateral distance of 40 inches from the bulb. Major STERN has seen roots of *Lilium leucanthum centifolium* six feet in length, but it is unlikely that the roots of many species are so extensive.

When making a permanent bed for a colony of Lilies the soil should be prepared for at least a foot beyond the outermost points at which bulbs are to be planted.

Question No. 6. DRAINAGE.

How is "drainage" defined? Should there not be a percolation test? Also, if drainage is assured by the compost used, is not drainage away from the site equally important?

Answer.

Drainage is a natural or artificial arrangement which permits any excess of water in the soil to percolate away and be replaced by air.

A Lily bed cannot be said to be well drained unless all surplus water readily passes away from it throughout the depth to which the roots should range. Consequently it cannot be well drained unless (1) the soil of the bed is porous and (2) there is somewhere for the surplus water to go. If the bottom of the bed is impervious, the surplus water must be able to get away laterally, and if it will not percolate through the surrounding soil, it must be taken away by means of a drain. Otherwise, if the bed be filled with porous soil it will become a sump.

Question No. 7. COMPOST.

Should it not be possible for everyone to make an artificial compost, identical in porosity, texture and feeding materials? For instance, would not Sorbex, leaf-mould and furnace ashes with the necessary chemical foods make a good compost?

Answer.

It is no doubt *possible* for all those who are prepared to go to the necessary expense to make an artificial compost of a given character as regards porosity, texture and feeding materials. But no one compost would suit all Lilies, nor does it seem economical to replace by imported materials the whole of the natural soil of a Lily bed. Having decided what Lilies he may reasonably expect to grow successfully, in view of the general nature of his soil, situation, etc., a

good gardener proceeds to adapt his soil to the varying needs of the plants rather than to exchange it for a variety of artificial composts which experience has shown to be unnecessary.

Turning to the suggested materials for an artificial compost, it is thought that soil of some sort, preferably loam, would be an essential constituent of any compost intended for a "permanent" planting of Lilies, and that for many Lilies soil should be the chief ingredient. Moreover, not everyone is satisfied that peat is better than, or even as good as, a first-rate sample of leaf-mould.

Question No. 8.

DISEASE.*

Could not this be controlled to a great extent by the use of potash? Experimenting with wood-ashes of unknown potash content seems to be a waste of time.

Answer.

Lilies are affected by two types of disease: (1) Those caused by viruses, and (2) those caused by fungi, of which the only one of importance is that due to *Botrytis elliptica*.

Virus diseases, which are by far the most widespread, cannot be prevented by the application of potash, nor can their effects be materially reduced by such means.

As to the disease caused by Botrytis, the Committee is not aware of carefully conducted experiments showing that potash supplied in wood-ashes or in any other form can prevent infection or reduce the severity of an attack after infection has taken place. It is improbable that potash in any form or quantity can prevent infection, and though it is probable that on a soil deficient in potash an application of a potash manure may make the plants more resistant to Botrytis, in no circumstances can one expect to control the disease by manuring. Efficient control should be sought in the light of knowledge of the life-history of the parasite, which has been dealt with in previous issues of the Year-book. (See 1932 vol., p. 59; 1933 vol., p. 194; and 1934 vol., p. 82.)

LILIUM WAREI.

LILIUM WAREI.

By DR. VOLLMER.

IN June, 1886, Messrs. T. S. WARE of Tottenham brought into flower a Lily that had a closely revolute flower of the same size and form as typical *Lilium pardalinum*, but of a clear, solid, rich yellow colour, unspotted, and very fragrant. This Lily created quite a stir at that time, and was rated as one of the finest of the world's Lilies.

The history of this Lily is most interesting. WARE obtained a shipment of Lily bulbs from a veteran dealer in forest-tree seed by the name of F. A. MILLER of San Francisco, who thought he was sending bulbs of *L. pardalinum*.

In course of time, all of the original shipment of bulbs was lost, and Mr. CARL PURDY of Ukiah, California, was asked to obtain more bulbs. PURDY got in touch with MILLER, and was informed that as far as he could remember the bulbs were collected by Mr. G. W. DUNN. PURDY communicated with DUNN and received the information that he thought he was sending bulbs of *L. pardalinum*, and that he dug the bulbs somewhere near Julian, San Diego County, California. PURDY then offered a reward to several collectors, and did receive bulbs of a fragrant *pardalinum*, but it was spotted and contained some red. So far, this Lily has not been rediscovered.

In 1932, Mr. P. R. OSCHANIC of Wilwaukie, Oregon, wrote to me that he had bulbs of *L. Warei*. I asked him for a few bulbs, but as he had only sixty, he was not parting with any, but was working up stocks. Further correspondence elicited the fact that OSCHANIC obtained the bulbs from a collector named Mr. HENRY DEHM, and he gave me his address. Later correspondence with OSCHANIC revealed the fact that he lost all of his bulbs. I wrote DEHM, who informed me he dug the bulbs near Springville. There are a number of Springvilles in California, so I chose the one nearest his address, which was in Ventura County. In December of 1932, I made a trip to Springville, Ventura County, and found nothing but cross roads, though a few miles distant were some hills. I explored these hills and found *L. Humboldtii magnificum*, but no *L. pardalinum*. I again wrote DEHM and was informed he meant Springville, Tulare County. The following summer, 1933, I made a trip to Springville, Tulare County, and as DEHM had given me detailed instructions as to where he had dug these bulbs, had no difficulty in locating the Lilies. In a small meadow, through which a small stream trickled, I found about 1500 stalks of Lilies, but none was in bloom. One, however, was turning colour; this I opened, and found it to be spotted. The next summer,

1934, again visited this meadow, and found a packer had pastured his cow in the meadow, and the cow had eaten off all the tops of the Lilies. I then walked down the stream for a distance of about a mile, found Lilies in bloom, but these proved to be the yellow form of *L. nevadense*.

In my early childhood, we spent our summer vacations in the mountains of San Diego County, near Julian, where DUNN was supposed to have collected the original bulbs of *L. Warei*. One ranch in particular where we frequently spent the summer had a beautiful garden, and the pride and joy of the lady were her "Tiger Lilies." I distinctly recall their fragrance, and also have a childhood recollection that while out hunting I would occasionally encounter the fragrance of these Lilies, and invariably would find where they were growing. In recent years, I have made five trips into the mountains of San Diego County, and once did find a fragrant *L. pardalinum*, but not *L. Warei*.

In San Diego County, there are a number of mountain ranges, namely Palomar, Cuyamaca, Laguna, Corde Madera, which are part of the Coast Range system, and these continue South into Lower California, Mexico, as the Sierra Juarez mountains. South of the last named mountains are the San Pedro Martir mountains, which contain a peak over 10,000 feet, and a level plateau of about 9000 feet. In the early days, there was no established boundary between Mexico and the United States, and it is quite possible that DUNN may have got into the Sierra Juarez mountains, of Lower California, Mexico, and was not in the mountains of San Diego County, California, when he collected the bulbs of *L. Warei*. PURDY informs me that he has been told by several people who have been in the Sierra Juarez mountains of seeing a yellow Lily. While there are many roads in the mountains of San Diego County, there is but one road in the Sierra Juarez mountains, which runs from Campo, California, to Ensenada, Mexico. This is a road in name only, and few pass along it.

In 1932, I made a pack trip into the San Pedro Martir mountains of Lower California, beginning at their Southern end, about 200 miles below the border, going through the mountains for a distance of about 30 miles. Small streams and ponds were encountered, the correct conditions for Lilies, but no Lilies were found. This fall, I am contemplating a trip beginning at the Southern end of the San Pedro Martir mountains, going North to the border on the East side, through the San Pedro Martir and Sierra Juarez mountains, then back again down the West side of both these ranges, hoping to find *L. Warei*.

Is *L. Warei* a true species, a variety of *L. pardalinum*, or a natural hybrid between *L. Parryi* and *L. pardalinum*? The fragrance and clear yellow colour are suggestive of *L. Parryi*, while the form is typical of *L. pardalinum*. The original shipment as received by WARE consisted of a number of bulbs—how many I have not been able to ascertain—but I do know that PURDY purchased three bulbs from WARE. These unfortunately arrived in a rotten condition, not so much so, however, but that PURDY was able to tell they had three jointed scales. Were



FIG. 6.—*LILIU BOLANDERI* AT TOWNHILL PARK.
(p. 7.)

[To face p. 16.]



FIG. 7.—PROFESSOR CROW'S HYBRID LILIES FIVE YEARS OLD.
(P. 23.)

L. Warei of hybrid origin, it is unlikely that all the flowers would be the same, for some would show the red of *L. pardalinum* and be spotted. Most likely it is a variety of *L. pardalinum*.

Why has not this Lily been rediscovered? To this question there are two answers. First, that DUNN dug the entire colony and it is now extinct. This is most unlikely, for in digging the bulbs some scales would have been broken off, and these in turn would have re-seeded the bed, as it were. The other answer is, that *L. Warei* awaits in some mountain recess to be rediscovered. I believe the latter to be true, and truly hope so. Botanically speaking, there are still mountain areas in California that have not been thoroughly explored. For example, last year while in Humboldt County of Northern California, I heard of a cup-shaped orange-red Lily that was found in Trinity County of Northern California. The description of the morphology was that of an Isolirion. The only Lilies of the sub-genus Isolirion in the Western Hemisphere are *L. philadelphicum* and *L. Catesbaei*. The latter is restricted to a small area in the South-eastern United States, while the former ranges from the East coast westward as far as Montana and British Columbia. This summer, the Botanical Department of the University of California received a Lily from a rancher in Plumas County, which may be *L. philadelphicum*, but the specimen was so wilted and damaged that positive identification was impossible. The first Californian Lily to be described was *L. pardalinum* in 1872 by KELLOGG, and the last to be described was *L. Kelloggii*, in 1901, although discovered earlier. Yet approximately forty years later, we find that perhaps *L. philadelphicum* is also native in California. Hence, there is a possibility that *L. Warei* may still be rediscovered.

Unless one were fortunate, a life time could be spent looking for this Lily. With a flowering season of a month at most, and the great area to be explored thoroughly, one could easily spend years and not find this Lily. For this reason, I have enlisted the service of the national forest service. The forest service publishes a bulletin which is sent to all the forest rangers, and in this bulletin, the forest service has kindly printed a short article about *L. Warei* requesting the rangers to be on the look-out for a Lily answering the description. So far I have received one reply which may be suggestive. This possibility I shall investigate this fall, dig a few bulbs, and hope to flower them next summer.

LILIES IN A BRITISH COLUMBIA GARDEN.

By BEATRICE L. PALMER, Cobble Hill, Vancouver Island, B.C., Canada.

WE are very pleased indeed to have an opportunity of contributing to this issue of the Royal Horticultural Society's Lily Year-Book. We have read and studied the issues of previous years with great interest, and have found the information on Lilies contained therein of inestimable assistance in our venture into Lily-growing.

As our Lily-growing is primarily for commercial purposes most of the bulbs are field grown, either in beds, slightly raised to ensure good winter drainage, or in rows where a wheel-hoe cultivator can help to cut down the hand weeding, but we also have groups of Lilies in the 'home garden,' planted to demonstrate suitable settings for various types in the perennial border, shrubbery, rock garden, etc.

Our climate here, on the east coast of the southern part of Vancouver Island, seems particularly suited to a wide range of Lily species. Winter temperatures seldom run lower than 12° F. (20° of frost) and, although there is often an excess of rain during December and January which makes good drainage essential, we have suffered no losses through winter injury to the bulbs. Lilies start to come through the ground early in March and occasionally *Lilium Hansonii* and the Martagons welcome a little protection from light frost at night followed by a bright sunny morning, but we have never had any Lilies really injured by late spring frosts.

Summers are usually dry and we expect very little rain from the middle of June to the end of August. This summer of 1938 has been exceptionally dry with less than $\frac{3}{4}$ in. of rain from the middle of May until the time of writing, August 12. A hot week in the middle of July, with temperatures reaching the unusual height of 87° in the shade, shortened the blooming season of the Princeps hybrids and those of similar type. It is not possible for us to give the Lilies much water, but they seem to do extraordinarily well in spite of this, and make hard, heavy bulbs with excellent root systems. One good soaking just before they come into bloom is all that most of them get, although the young seedlings and a few specially favoured kinds are given more.

The main Lily plantings are on ground which has been under cultivation for about fifteen years. It is a sandy loam with a liberal sprinkling of small stones. Sloping gently to the north-east it is protected from wind by a belt of trees on the north, east and south, and gets the full benefit of sunshine throughout the day. As a ground-

cover Elk's Pride Petunias have been allowed to seed themselves all through the Lily plantings. Besides affording some shade to the ground, their violet-blue flowers form a pleasing contrast to the Lily blooms and continue to give colour to the garden long after the main show of Lilies is over.

Until recently we had no suitable location for the shade-loving Lilies, but two years ago we cleared a bit of 'bush,' grown thick with wild cherry, Douglas firs and an underbrush of Sal-lal and bracken fern. It is in a corner and is shaded for the greater part of the day by large forest trees on the south-east and south-west. The land is uneven, mostly a stiffish loam with patches showing some clay, and the Lily bulbs planted there in October 1937 are thriving. Amongst them are *L. giganteum*, *L. Washingtonianum*, *L. monadelphum*, *L. Szovitsianum*, *L. cernuum*, *L. formosanum* and *L. Henryi*. They have made very good growth for the first season and seem to find the 'new' land and partial shade congenial.

NOTES ON SPECIES.

L. amabile thrives in our light sandy soil in full sun, and grows freely from seed, usually blooming in the second year.

L. auratum. In company with a great many other people we have found it difficult to buy virus-free stock of the Auratum Lilies, and growing them from seed under our conditions seems a comparatively slow process. We now have seedlings blooming from seed sown in flats in spring of 1933, transplanted to open ground in fall of 1935. There is considerable variation in form, colour, spotting, etc., and some very fine types amongst them. A neighbouring commercial florist, with greenhouse facilities, has plants producing up to five blooms to a head in the third year from seed. And we understand that a grower at Langley Prairie, B.C., who has rich 'alder-bottom' land, has 30,000 Auratums from seed sown in April, 1935, about 100 of which are blooming this year. Prospects begin to look better for home-grown stock of these lovely Lilies.

L. Brownii we consider one of the loveliest Lilies in cultivation. It does well in almost any location, given good winter drainage and a moderate amount of water at blooming time. We have not yet been able to induce it to set seed, either with its own pollen or that of any other available Lily, but scales taken in early October have produced fine bulbs for planting out the following fall.

L. bulbiferum produces quantities of bulblets, but very few blooms which do not seem to us worth the trouble of growing. Possibly we have not given it the right care or location.

L. bulbiferum croceum, of which we are fortunate in having stock of the true plant, is a vigorous grower, quite distinct in its branching habit and late season of bloom from the various forms of *Umbellatum* which are sometimes confused with it.

L. candidum, both the type and the Salonika variety, does well. The type is a little inclined to Botrytis blight, but not to any serious

extent. We find the usual precaution of removing the winter-hardy leaves as soon as new growth starts in the spring is sufficient to check the spread of this trouble.

The Salonika variety seems to have all the good qualities attributed to it. Of vigorous habit and fine flowering form, it sets seed freely with its own pollen and the seed germinates quickly.

L. cernuum is a most attractive little Lily, holding it's colour and delicate fragrance best in partial shade. Although the bulbs are said to be comparatively short-lived, it comes very freely from seed, blooming the second season.

L. chalcedonicum grows and blooms well, but seems subject to a form of Botrytis which causes the lower leaves to turn brown and die shortly before the blooms open. We have it in a sunny situation, but intend trying some in partial shade in the hope of inducing the whole plants to stay green throughout the season. A liberal top-dressing of wood ashes has seemed to be of some assistance.

L. columbianum is one of our native Lilies, locally found near the edges of woods where the slender stems reach up through bracken and underbrush to a height of four feet, carrying a head of from two to six bright golden-orange blooms. Under garden conditions the stems are much stronger, reaching a height of six feet, and there may be as many as thirty blooms to a head.

L. concolor type and the Dropmore variety both thrive in full sun. The latter is a distinctly larger, taller, showier Lily and also sets seed much more freely than the type under our conditions.

L. Davidi grows very vigorously with us and attracts much attention during its blooming season. Our plantings are in full sun and, although they had no artificial watering this summer, many reached a height of five feet with strongly erect stems and large, brilliantly coloured flowers. We consider this one of the most satisfactory Lilies we grow.

L. formosanum, Price's variety, is exceedingly easy to grow and should be included in every garden. Seed germinates exceptionally freely and the seedlings soon make second leaves and sometimes even flower the same year. We have grown this Lily in partial shade, in full sun and in wooden tubs and find it most satisfactory under all conditions. Its comparatively dwarf habit makes it especially suitable for pots or tubs.

We purchased a few bulbs of *L. formosanum*, Wilson's variety, last fall and they appear to be doing well although they do not yet (August 12) show any signs of coming into bloom.

L. giganteum has amply repaid us for special attention to planting instructions included in Mr. W. A. CONSTABLE's most excellent catalogue. We purchased our original three bulbs from Mr. CONSTABLE and have had magnificent blooms, a comparatively large number of offsets and a quantity of seed.

Our experience with growing the seed may be of interest. Part of the seed collected in the fall of 1936 was placed in a neighbour's re-

frigerator, next the ice in a damp cloth, for a week. Then it was sown in a flat early in November. A similar flat was sown at the same time with seed which had not been frozen, and both flats were left in a cold frame throughout the winter. Neither showed any signs of germination in 1937, but they were kept moist through the summer and again left in the cold frame during the winter months. Early in April, 1938, the 'frozen' seed started to germinate and came up rapidly, almost every seed appearing to have grown. In the flat of check seed, which had not been frozen, not more than half a dozen seeds germinated and these were three weeks later in showing up than the 'frozen' seedlings. In previous years we have found it very difficult to get seed of *L. giganteum* to germinate, either in flats or planted in the open ground, and seedlings have never shown up until the second spring after planting.

L. Hansonii grows easily, but the colour bleaches out rapidly unless it is grown in shade. Except for its ease of cultivation and possibilities for hybridizing purposes we do not consider it an attractive Lily.

L. Henryi will grow vigorously in practically any part of the garden. The colour is inclined to bleach out in the sun and we therefore usually plant it in partial shade.

L. Humboldti magnificum does best where it gets some shade and a sufficient supply of moisture during the summer months.

L. Martagon album thrives in a sunny location, but comes up so early that it sometimes has to be protected from spring frosts. The graceful plumes of fragrant blossoms are a feature of the garden in June. Seed planted in the early spring usually fails to show any growth above ground the first summer but true leaves come up the following spring.

L. Szovitsianum was originally planted in light sandy loam in full sun where it failed to grow taller than two feet and, although it bloomed, did not seem happy. Last fall it was moved to heavier soil in partial shade and grew to $3\frac{1}{2}$ feet this summer with much finer flowers than formerly.

L. ochraceum is not generally considered to be fully hardy outdoors here and we have therefore grown it in wooden tubs, which are kept in a frost-free cellar through the winter. We have had some very fine blooms, but it does not seem a dependable Lily and the colour amongst different seedlings varies considerably.

L. Parryi, the lovely yellow Californian Lily, bloomed well the first season after planting, from bulbs secured from an Oregon grower, but failed to show up at all the next year. The bulbs appeared to have perished in the ground. Fortunately we had saved seed which grew well and the resultant bulbs bloomed in their third year.

L. regale is thoroughly dependable in any part of the garden, and does not require any particular care beyond good winter drainage.

L. rubellum is almost invariably the first to bloom and seems to enjoy a position in partial shade. We have also found it excellent for pot cultivation.

L. Sargentiae we have discarded entirely until we can either grow our own stock from seed or secure guaranteed virus-free bulbs. Although the bulbs we had grew and bloomed well, we strongly suspected them of infecting other nearby Lilies with virus.

L. speciosum. These most desirable Lilies suffer from the same troubles as the Auratums and we have found it almost impossible to buy virus-free stock. Blooming so late, they seldom ripen seed unless grown in a greenhouse, but it is to be hoped that home grown bulbs will be available in the near future.

L. myriophyllum superbum does not thrive in the garden with us as it seems to come up too late in the spring and never catches up through the season. But bulbs grown in wooden tubs, given plenty of water during the growing season, bloom well and are most satisfactory.

L. tenuifolium. Both the type and the variety 'Golden Gleam' grow well in a sunny position and are amongst the earliest to bloom. Although the bulbs are said to be comparatively short lived, there is always plenty of good seed which germinates freely, and the seedlings usually bloom the second season.

L. tigrinum is invariably a vigorous grower and can be depended on to give a good show of bloom in August.

L. Washingtonianum is a comparative newcomer to our garden, but is doing well in partial shade where it gets good drainage in the winter and a fair amount of summer moisture.

L. Willmottiae flourishes in full sun and looks particularly well planted near the brilliant orange Milkweed, *Asclepias tuberosa*.

NEW HYBRID LILIES.

Outstanding amongst the new hybrid Lilies that we have grown are the following:—

BELLINGHAM HYBRIDS. The late Dr. DAVID GRIFFITHS, of the United States Department of Agriculture, devoted considerable time and attention to Lilies and raised some notable hybrids at the Government Bulb Farm, Bellingham, Washington. Dr. GRIFFITHS was particularly successful with crosses between *L. Humboldtii*, *L. pardalinum* and *L. Parryi*, and from several hundred seedlings a few were selected as being outstanding.

Of the *Humboldtii* x *pardalinum* crosses we have grown,

'Cyrus Gates' is a very vigorous grower with broad-petalled, reflexed flowers of rich orange yellow, spotted deep purple in the centre and reddish bronze towards the tips. This is a very showy variety reaching a height of six feet.

'Douglas Ingram,' shows some resemblance to *L. pardalinum* in its colouring, being orange-red with deeper red towards the tips, spotted black. Mature bulbs often send up three or four spikes, four to five feet tall.

'Kulshan' is the first to come into bloom, and during this particularly dry, hot summer one eight foot spike of thirty-six blooms

lasted from June 1, when the first opened, to July 29 when the last faded. It is a clear deep orange, profusely spotted, with purplish-red anthers and orange pollen.

'Sacajawea' has reflexed flowers of deep orange-yellow, spotted black with reddish-brown anthers. It is the tallest we have grown, reaching a height of eight and a half feet, with a widely branched head of perfectly placed blooms.

In spite of their height, none of these varieties needed staking, and they are all excellent subjects for the open woodland or perennial border.

CROW'S HYBRIDS. The late Professor J. W. CROW, of Simcoe, Ontario, was successful in crossing *L. × Sulphurale* and *L. × Princeps*, thereby producing a new race of magnificent trumpet Lilies. We have grown several hundred seedlings from selected types of the original Crow's Hybrids and find them, almost without exception, strong vigorous plants, growing from four to seven feet tall, with well-branched pyramidal heads of from 6-30 large blooms (fig. 7). They cover a blooming season of over five weeks, the first opening as the Regals begin to fade. The majority of them are similar to the Crow's Hybrids in their distinct creamy tone of colouring, some having greenish-yellow throats and others clear yellow. Anthers vary from yellow to orange and dark brown.

MISS PRESTON'S HYBRIDS. We are indebted to Miss ISABELIA PRESTON, Expert in Ornamental Horticulture at the Central Experimental Farm, Ottawa, Ontario, for several of the finest hybrid Lilies in cultivation. Exceptionally outstanding are those resulting from crossing *L. Willmottiae* with a *L. dauricum* seedling. As a group they have combined the best qualities of both parents, having tall strong stems with well-spaced branching heads of brilliantly coloured blooms, much larger than *L. Willmottiae* and facing outward instead of drooping.

Two of these fine Lilies, 'Grace Marshall' and 'Lyla McCann', have already been given Royal Horticultural Society Awards. 'Lillian Cummings' is the earliest to bloom and propagates very rapidly. 'Phyllis Cox' is particularly brilliant in colouring, with bright orange-red flowers which are golden-orange on the backs of the petals.

We have been successful in propagating all of these varieties from scales, which are taken in October, planted in flats filled with a mixture of sandy soil and peat moss, and kept in a frost-free cellar during the winter. By the following fall they make good-sized bulbs to set out.

L. × 'Tigrimax', as its name suggests a hybrid of *L. tigrinum* and *L. Maximowiczii*, is another fine Lily originated by Miss PRESTON. It is a very strong-growing hybrid, similar in size and type to *tigrinum*, with the characteristic woolly buds of *Maximowiczii*. The colour and general effect is distinctly softer and more pleasing than that of *tigrinum*. It does not carry bulbils in the axils of the leaves.

L. × princeps var. 'G. C. Creelman,' is one of the finest trumpet Lilies in cultivation and as easy to grow as *L. regale*. Groups planted amongst Rhododendrons are particularly good.

LILIUM GRAYI AT HOME.

By MARY G. HENRY.

DURING June of 1937 I had the pleasure of collecting *Lilium Grayi* in its native habitat. I found it in four different stations in valleys in the Blue Ridge Mts. in Virginia, at altitudes of about 1,200 ft. to 2,000 ft.

In each of these instances the Lilies grew three or four inches deep in rather dense loam in sunny grasslands. Twice they were in rather moist soil and twice in dry ground that was far from rich. Quite likely all these places were comparatively dry during July, August and September.

In the moist soil *L. Grayi* grew about four feet tall and produced up to twelve blooms on a stem.

The plants that were in the dry soil stood about two and a half to three feet tall and carried one, two, or rarely three flowers.

It was interesting to note the variations.

The flowers of *L. superbum* vary little in form and as a rule there are surprisingly few variations in colour considering the vast quantities of this Lily which have been collected. However, I have, of late, found some extraordinarily handsome colour forms of this truly "superb" Lily.

The flowers of *L. Grayi* differ considerably in form, often even in the same colony.

The first time I found *L. Grayi* there were about 25 plants growing near each other, and the flowers, which were a muddy red, varied in form from rather narrow ones shaped like an almost straight-sided bell to those whose perianths flared widely, sometimes with slightly reflexed tips. The latter were vastly more attractive than the former.

The next time I found them there were about the same number in the colony, but they were farther apart from each other, perhaps one to several feet. Similar variations in shape occurred, but this time the flowers were all coloured the typical, wonderfully beautiful, deep rich crimson red.

The third time I found *L. Grayi* there was a great mass of perhaps 500, probably more, of these Lilies in full bloom. They caught my eye from a distance and made a handsome spectacle, colouring as they did a large section of an open meadow. A stream flowed lower down beyond them, but except in an unusually wet season the water could not have reached the bulbs, and even then it would have been but for a brief period. The flowers of these plants, too, varied

considerably in shape with many gradations like the others; in colour they scarcely varied at all. Nearly all were the same crimson red with but few muddy tints, and almost all had the usual dark spotting on a yellow ground inside. A few, however, were spotted on a red ground with only a slight paling towards the heart of the flower. The copious blackish spots on the dark ground gave a very rich appearance to the flower.

The fourth occasion on which I saw these Lilies there were some 50 or 60 plants dotted over about an acre of land. The flowers here were quite uniform both in shape and colour, and in having a spreading slightly reflexed perianth.

All these meadows either were or had been fenced, and no doubt had been grazed over by cattle which were plentiful in the hills. Probably at an earlier date the Lilies were far more abundant in these localities, for neither cattle nor sheep have any respect for Lilies. Nor does the farmer, as I have seen on more than one occasion, where quantities of them had been mown down with hay. Alas, so goes many a beautiful native flower!

Now and then when I entered a forest I noticed a Lily or two, but they were not in bloom. These were a trifle taller, but the bulbs were not more than four inches below the surface.

It may be seen from the foregoing notes that *L. Grayi* grows under rather commonplace conditions in its native home. Its wants are simple and when understood there should be no difficulty with it.

Although *L. Grayi* is far from being among the most "showy" Lilies, in its finer forms, to my mind, it can hold its own with the best, and when we find it in its native haunts, where several of its slender stems are carrying their beautifully but delicately formed flowers that are so singularly richly coloured, we realize that here, indeed, is one of the choice floral treasures of Eastern North America.

THE *LILIUM DAVIDI-SUTCHUENENSE-WILLMOTTIAE*
SERIES.

A REVISED CLASSIFICATION.

By A. GROVE and A. D. COTTON.

PROBABLY no species of *Lilium* are so urgently in need of a re-statement as those grown under the name of *Lilium Davidi*, *L. sulchuenense* and *L. Willmottiae*, and the allied forms and hybrids associated with them.

The Lilies in question have already been the subject of several articles by one of us (A. G.), some of which have been illustrated by photographs of types and other pertinent specimens. A detailed account of their earlier history was, moreover, provided by Sir WILLIAM WRIGHT SMITH in his paper on Chinese Lilies published in 1922 (*Trans. Bot. Soc. Edinb.*, xxviii, p. 141). Sir WILLIAM, however, did not see type specimens of *L. Willmottiae* and intentionally left the status of that species uncertain. Soon after the publication of this paper WILSON dealt with the species in *The Lilies of Eastern Asia*, but, although elucidating some points, his treatment cannot be accepted in its entirety.

A re-investigation of the whole problem has therefore been necessary, especially since the Lilies have for long been cultivated in China and are of much horticultural importance in this country and in America. A full review of the literature will be provided in Part 6 of the "Supplement" to ELWES's Monograph of the Genus *Lilium*. The following account has been prepared in order that readers of the Lily Year-Book may be informed as to the facts and arguments that form the basis of the slightly revised classification which it has been found necessary to adopt. The various hybrids have not yet been investigated.

The first question was the correct interpretation of the "type" specimens on which the species were founded. Tedious though such an enquiry may seem to the gardener, it is essential for finality. In each case the actual "type" together with the whole of the original gathering has been examined, and the diagnostic features of each are recorded below. Their status is then discussed, not merely on the evidence of the old specimens, but in the light of knowledge gained from the study of further wild specimens and from cultivated material.

L. DAVIDI

Being the first of the group to be described, this species is, nomenclaturally, the basal unit for the whole series, and must therefore be considered in special detail. It was collected by Père DAVID, and the type specimen, which is in the Paris Herbarium, bears the legend, "Récolte parmi les grandes montagnes qui séparent Moupin du Szechuan en Juillet, 1869." At ELWES's personal request the specimen—a very poor one—was named after its discoverer by Prof. DUCHARTRE, and DUCHARTRE's description was published by ELWES in his Monograph (March, 1877). This fact accounts for the citation in botanical literature "Duchartre ex Elwes." A photograph of the specimen was reproduced later by Sir WILLIAM WRIGHT SMITH (loc. cit., pl. 7). (See also A. GROVE, Gard. Chron., Feb. 10, 1923, p. 78.) A coloured plate was prepared at the time from DAVID's inadequate specimen and this was reproduced by ELWES in the Monograph. In the absence of a field-note as to colour, the artist (M. FAQUET) portrayed the flowers as yellow, though in his description ELWES states that they were "apparently orange." Imperfect as the type specimen is and the worse for subsequent examination, it shows the following features, all of which were noticed by ELWES: (1) a scabrid stem, (2) narrow leaves (2 mm. wide) apparently involuted at the margins, (3) hairs at the axils of some of the leaves, and (4) long white hairs on the outer perianth segments and at their base, the latter forming the "downy corolla" referred to by ELWES. This is all that can be gathered from the type itself.

Passing to WILSON's description published in 1925, it will be observed that, though he alludes to other features, all the above characters are prominent in his concept of the species. His words are: "This species is distinguished by its erect, rigid, scabridly pubescent stem, by its narrow, prominently 1-nerved leaves, with strongly recurved, minutely toothed, scabrid margins and costa, papillose on both surfaces, and by its rigid pedicels and more or less floccose flower buds. . . . Usually the culm rises erect from the bulb." In the technical description he refers to the tufts of hair at the leaf axils (loc. cit., p. 82).

L. SUTCHUENENSE.

The next species to be considered is *L. sutchuenense*, described by FRANCHET in September, 1892, and founded on two distinct gatherings which consist of two slightly different plants. The first gathering cited consists of a single specimen collected by Prince HENRI D'ORLÉANS near Ta-tsien-lou in Szechwan (about 50 miles west of DAVID's locality). The second is represented by four sheets collected by Père PAUL FARGES in the district of Tchen-kéou-tin (—Cheng-kow-tin, nearly 400 miles to the east in the same Province and on the border of Shensi). Both gatherings, which are undated, are in the Paris Herbarium.

* See note p. 164.

Prince HENRI's specimen consists of a small shoot (cut off above the bulb) with a scabrid stem, bearing short, closely arranged, narrow (2 mm. wide) leaves, with inrolled margins and tufts of hair at the base. It possesses a single flower, the outer segments of which show the presence of a very few silky hairs. WILSON examined this specimen and referred it to *L. Davidi*—a view which may be accepted as correct. FRANCHET's description of *L. sutchuenense* included Prince HENRI's specimen, but it evidently embraced, and was apparently mainly based upon, the four specimens collected by FARGES. The references to the bulb, leaf measurements, and pedicels prove this. According to the International Rules, if it is necessary to exclude part of an original gathering, the type of the species must be selected from the remainder (provided it agrees with the description). Prince HENRI's specimen being excluded (as being identical with *L. Davidi*) FARGES' gathering automatically becomes the type of *L. sutchuenense*, and the most perfect specimen with bulb, leaves, flowers, and which in the present case happens also to bear the original field label, may be taken as the actual type or "lectotype." There is no reason to doubt, however, that his other three specimens, though they differ slightly and bear more numerous flowers, represent the same species. In all four specimens the stem is scabrid in the lower part : the leaves are longer and broader than those of *L. Davidi* (up to 6 mm.) and not inrolled at the margins ; and the flowers, including the single bud present, are devoid of hairs. The flowers, described by FRANCHET as deep red-orange, are densely spotted, and, except in two specimens, are numerous and borne on long slender pedicels (fig. 8).

FRANCHET in his description made no reference to *L. Davidi*. He relied probably on ELWES's plate and regarded it as a yellow Lily in no way related to his species. Comparison of FARGES' specimens of *L. sutchuenense* with *L. Davidi* shows that the former differs in (1) the flat leaves, which are also longer and broader, (2) the absence of hairs at the leaf base, (3) the somewhat longer pedicels, and (4) the glabrous perianth.

L. Willmottiae.

The original specimens on which the species was founded were collected by E. H. WILSON at Fan Hsien in the adjoining province of Hupeh and were described by him in the Kew Bulletin for 1913 (p. 266). There are several sheets of the type number, 693, which have been kindly sent to Kew on loan from the Gray Herbarium at Harvard University. The most perfect specimen, which is shown on fig. 9, may be taken as the lectotype. WILSON provided a long Latin description, but though he differentiated his plant from *L. Thayerae* (another new species which he described simultaneously, but subsequently reduced to a synonym of *L. Davidi*), he did not indicate how it differed from *L. Davidi* or *L. sutchuenense*.

In comparing *L. Willmottiae* with these two species it will be

preferable to consider WILSON's mature views as expressed 12 years later in *The Lilies of Eastern Asia*. Having *L. Davidi* evidently in mind he states that his *L. Willmottiae* is characterized by (1) the presence of a creeping underground stem bearing bulbs, (2) the leaves being crowded, relatively long, rather narrow (actually 4-6 mm. wide), obscurely 3-nerved with plain margins, (3) the stem and pedicels being slender and not sufficiently rigid to carry erect the racemose inflorescence and the flowers, and (4) the glabrous nature of the flower buds. These characters, with the exception of the underground stem and the drooping pedicels, may be confirmed from the type specimens. WILSON's knowledge of the drooping habit was presumably gained from field observations or from cultivated specimens, since in his dried specimens the flowers do not show this disposition. It may be added that the leaves of his specimens, being 4-6 mm. wide, are relatively broad and that the stem, though smooth in the upper threequarters, is slightly scabrid at the base. The features emphasized with regard to the stem, leaves and flower-buds are therefore precisely those characteristic of *L. sutchuenense*. The specimens also correspond exceedingly closely with those of Père FARGES (compare figures 8 and 9) and, as WILSON himself admits, there is no doubt that the two plants are conspecific. He should therefore have discarded the name of *L. Willmottiae* in favour of the older *L. sutchuenense*.

WILSON's views on the matter and the reasons he advanced for retaining his own name were clearly stated. When he first described the species in 1913 he was probably unaware that it was identical with the plant discovered by Père FARGES (though he was evidently familiar with the Paris sheets), but later, before preparing the text for his volume, he carefully re-investigated the whole matter. After pointing out that Prince HENRI's specimen of *L. sutchuenense* represented *L. Davidi*, and that Père FARGES's specimens were referable to his own species, he added: " Franchet's *L. sutchuenense* covers two species and his name is, therefore, invalid" (*The Lilies of Eastern Asia*, p. 68). This deduction and the rejection *in toto* of Franchet's name in favour of *L. Willmottiae* was, however, unjustifiable and contrary both to the International Rules and also to the New York Code, which up to 1930 was followed by certain American botanists. As has been shown, when Prince HENRI's plant was excluded, the FARGES specimens became the type. If it be argued that Prince HENRI's plant was identical with FARGES's plant (as Sir W. WRIGHT SMITH believed possible) it only strengthens the case for the preservation of the older name. WILSON was naturally reluctant to abandon his name, which commemorated a distinguished patron of his expedition, but unfortunately the reason he advanced for its retention was not justifiable and cannot be accepted. Mixed gatherings are unfortunately only too common. Were the arguments advanced by WILSON generally adopted by botanists, wholesale alteration of names would result.

The status of the Lily—particularly its claim to retention as a species—will be discussed later, but it may be emphasized again that if the plant be maintained as a species there is no question that WILSON's name must be abandoned and FRANCHET'S *L. sutchuenense* substituted. It may further be noted that the view, recently put forward, that the pale-spotted Lily of this series known in the horticultural world as *L. Willmottiae* var. *unicolor* represents the true *L. sutchuenense*, is also one which cannot be maintained.

L. THAYERAE.

As this species is involved in the history of the two Lilies dealt with above, a brief statement as to its identity is necessary. The type specimen was collected by WILSON at Tatsienlu, where Prince HENRI collected *L. Davidi* about 40 years before. WILSON stated that it was common on the adjacent rocky mountain slopes of the Sino-Tibetan frontier. At first he referred it to *L. sutchuenense*, but after more critical consideration he decided that, as had already been pointed out (GROVE, Gard. Chron. Aug. 16, 1913, p. 115), it differed from that species, and he therefore described it as new under the name *L. Thayerae* (Kew Bulletin, 1913, p. 266). He remarked that his new plant differed from *L. sutchuenense* in several characters, such as the rigid stem, linear leaves with revolute margins, and villous flowers. About 1920, however, his views underwent further modification and in The Lilies of Eastern Asia he expressed himself in the following words : “It was a shock to me to find that my Lily was the same as the *L. Davidii* Duchart. of ELWES' Monograph” (pp. 82-83, including footnote). The original specimen of *L. Thayerae*, kindly sent to Kew on loan from the Gray Herbarium, has been examined and there is no doubt that WILSON's final conclusion was the correct one.

It will be realized, therefore, that the four names which have been discussed represent only two Lilies—namely, *L. Davidi*, with *L. Thayerae* as a synonym, and *L. sutchuenense*, with *L. Willmottiae* as a synonym. An account of their subsequent history and of their behaviour under cultivation is not necessary for the purpose of this article, but will be summarized in Part 6 of the “Supplement.”

DISCUSSION.

We may now consider the taxonomic status of the two Lilies. Although our ideas of *L. Davidi* rest upon a somewhat inadequate basis, this has been exhaustively investigated and the typical form as elucidated and defined by WILSON may be accepted as correct (with the exception of his statement as to the non-creeping stem). *L. sutchuenense* (= *L. Willmottiae* Wilson) is much better known both from herbarium sheets of wild material and from authenticated plants cultivated in gardens. As shown above it is only separated from *L. Davidi* by trivial characters. The question for consideration is whether it differs sufficiently to warrant retention as a separate species.

The characters which have been used for differentiation are discussed *seriatim* in the following paragraphs.

(1) *Stoloniform Stem*. In his Key to the Martagon group of Lilies WILSON distinguishes two groups: (1) Bulbs stoloniferous and (2) Bulbs not stoloniferous (loc. cit. p. 15).^{*} His *L. Willmottiae* finds a place in the former group and *L. Davidi* in the latter. Few published observations as to the base of the stem in *L. Davidi* are available, but "running" undoubtedly occurs (as indeed WILSON indirectly implies in his text). It has been observed, for instance, in plants grown at Kew, especially in young bulbs, and Mr. RAFFILL informs us that the form which he isolated and named var. *macranthum* "runs" very extensively. A large planting of this variety in another garden exhibited the same condition. Though the tendency is greater in *L. Willmottiae* there is no question that both Lilies produce stoloniform stems and that WILSON was in error in grouping *L. Davidi* with such Lilies as *L. Martagon* and *L. tigrinum* the stems of which never run. It is probable, however, that the development of the creeping stem varies in extent according to the age of the bulb, the nature of the soil, the amount of moisture present, and possibly also in different strains. WILSON doubtless drew his conclusion from limited material.

The possession of a creeping underground stem explains in part the feature known to gardeners, but not mentioned by WILSON, namely, the curious oblique manner in which the shoots of *L. Willmottiae* emerge from the soil. This is obviously not the whole explanation, however, since the shoots of other Lilies which "run" usually arise almost vertically.

(2) *Bulb-shape*. Though not emphasized by WILSON this feature has been held to be of diagnostic significance, bulbs of *L. Davidi* being regarded as rhomboid and those of the other Lily as obovoid. An examination of the plants grown at Kew and elsewhere has not confirmed this. In order to obtain ample evidence on the point a special visit was paid to the Burnham Nursery at the season when large stocks of these Lilies were being lifted. Considerable variation in bulb-form was noted and no constant distinction in shape between the two Lilies could be detected.

(3) *Leaves*. The leaves present more tangible differences if care be taken to examine plants of comparable age. The leaves of *L. Davidi* are usually shorter, up to 8-10 cm. long, 1-nerved and not more than 2-4 mm. wide; the margins are inrolled and slightly scabrid. Those of *L. Willmottiae*,[†] on the other hand, are longer (up to 16 cm.), 1- or obscurely 3-nerved and up to 6 mm. wide; the margins are not inrolled. The tuft of white hairs at the point of insertion is often

* Strictly speaking the creeping underground part of a Lily stem is not a stolon, hence the bulb cannot be spoken of as "stoloniferous." The horizontal underground part of the stem *resembles* a stolon in appearance, and the term "stoloniform" which has been employed is more correct.

† As this article will be chiefly read by horticulturists, the more familiar but invalid name of *L. Willmottiae* is used instead of *L. sutchuenense* throughout this discussion.

copious in *L. Davidi* and usually, but not always, absent in *L. Willmottiae*. The character has, however, little value.

(4) *Flowers*. No essential difference has ever been emphasized in flower structure. In colour *L. Willmottiae* is a deep orange red and the best forms of *L. Davidi* are scarlet, but the colour varies within certain limits in both Lilies. The presence of hairs on the flower buds of *L. Davidi* and their absence on the other Lily is usually constant, but exceptions occur. This character is a useful guide, but cannot be said to have specific value in the genus *Lilium*.

(5) *Stem and inflorescence*. The stem of *L. Davidi* is usually green, speckled with brown, and scabrid, whilst that of *L. Willmottiae* is usually scabrid only at the base and is often so heavily speckled as to appear brown. The most marked difference, and one very striking in the garden, concerns its poise. In *L. Davidi* the stem is erect and rigid, the flowers are relatively few, widely spaced and held horizontally. In the other Lily the flowers are numerous, closely arranged and the pedicels long and drooping. The stem itself, as WILSON says, is not sufficiently rigid to retain the inflorescence erect. As has been aptly said (GROVE, Gard. Chron. May 6, 1922, 228), *L. Willmottiae* sets more sail than it can carry and it is probable that the drooping habit is related to the very copious production of flowers. In extreme forms this difference is very marked, but loses much of its force owing to the existence of intermediates which are plentiful under cultivation and, as shown by the FORREST specimens at Edinburgh, occur also in the wild state. Under garden conditions vegetative propagation may have artificially accentuated the prevalence of certain types.

CONCLUSIONS.

I. In our opinion there can be no question that all the Lilies of this series should be placed under the single species, *L. Davidi*, and that *L. Willmottiae* should be given varietal rank under that species. There is no difference in the structure of the flowers. The distinguishing features of *L. Willmottiae* are largely vegetative, such as closer internodes, drooping habit and certain differences in leaf measurements. Even were one disposed to take a narrow view of species, none of these can be said to give the plant a strong claim to the higher rank. The existence of intermediates reduces that claim to almost negligible proportions. The two Lilies are much less distinct one from the other than the various forms found in such species as *L. speciosum*, *L. ochraceum* or *L. auratum*.

This decision accords with that arrived at by Sir WILLIAM WRIGHT SMITH in 1922, though he reached it by a somewhat different method. After a detailed historical survey he subjected FORREST's dried specimens to a critical study and showed that they bridged the gulf between the two Parisian types, and he observes in conclusion: "This [*L. sutchuenense*] is not more than at most a variety of *L. Davidi*." He did not, however, realize that *L. Willmottiae* was identical with *L. sut-*



FIG. 8.—*L. SUTCHUENENSE* DESCRIBED BY FRANCHET IN 1892.
One of the original specimens with the original (lower) label. The upper label was added later by WILSON and the name *L. Willmottiae* has been added also to the original label.

(p. 28.)



FIG. 9.—*L. WILLMOTTIAE* DESCRIBED BY WILSON IN 1913.
One of his original specimens. Conspecific with *L. sutchuenense*.

chuenense nor did he state definitely whether *L. sutchuenense* was to be regarded as a form or variety, or specify the name it should bear (loc. cit., p. 149).

2. The name *L. Davidi* var. *Willmottiae* has been selected. It has been shown that if the plant were retained as a species it would be necessary to substitute the name *L. sutchuenense* for that of *L. Willmottiae*. When a change of rank, however, is involved, the oldest validly published name in the new rank must be used. In the present instance no varietal name exists (the Lily in question has, apparently, never been designated as a variety). Since it is not essential to adopt a name used in the old rank there is complete freedom of choice. But in the case of such an extensively grown garden plant, it is preferable to select one of the two existing specific names. The epithet *sutchuenense*, in common with many other Franchetian names was accompanied by a poor description, has been misunderstood, and has largely slipped out of use, or when used generally wrongly employed. On the other hand, WILSON's name (though not justifiable as a specific epithet) was accompanied by a full description and later connected with a Botanical Magazine plate. It has always been understood and correctly employed, and the Lily is known to gardeners by that name probably in the five Continents. It is commemorated moreover in the magnificent hybrid 'Maxwill' and in the less known *Davmottiae*. There are, therefore, overwhelming reasons for the selection of the epithet *Willmottiae* for the varietal name.

3. We have not attempted to deal with all the forms which have been observed of this series of Lilies. Our object has been to clarify the position by showing that there exist certain "fixed points" (which are provided by the old "type" specimens) to which certain names are definitely attached. By means of these fixed points it is possible to present a classification and nomenclature which we believe to be botanically sound and which we hope will be acceptable to horticulturists.

The revised classification (in which we have included the two other varieties of *L. Davidi*), together with the principal synonymy, may be outlined as follows:—

L. Davidi Fr. (*L. Thayerae* Wilson, 1913). Stem erect, rigid, up to 3-4 ft. high, usually arising from a short stoloniform base. Leaves crowded, rather short (9-12 cm. long and 2-4 cm. wide), flat or slightly inrolled at margins. Buds slightly or densely hairy. Flowers rather widely spaced, of various shades of orange-red, or scarlet; pedicels horizontal.

var. **macranthum** Raffill. Differs from typical *L. Davidi* in the stout, more vigorous stems (up to 6 ft. high) and larger flowers, the lower pedicels of which are usually 2- or 3-flowered. Flowers scarlet. A very vigorous variety isolated by Mr. C. P. RAFFILL.

var. **Willmottiae** (Wilson) Grove et Cotton, comb. nov. (*L. sutchuenense* Franch., 1891, *L. Willmottiae* Wilson, 1913). Differs from the typical *L. Davidi* in its more slender and arching stem and

drooping pedicels, and in the slightly longer and broader leaves (up to 16 cm. long and 6 mm. wide) which are not inrolled at the margins. The young stem, which is markedly stoloniform, usually emerges obliquely from the soil. Flowers more numerous and more closely arranged than in *L. Davidi*, a condition which tends to accentuate the drooping habit. Buds glabrous.

var. **unicolor** (Hort. van Tubergen) Cotton (*L. Biondii* Baroni, 1895). Differs from typical *L. Davidi* in the shorter stature (up to 3 ft.), in the very crowded, rather longer, narrow leaves (2-4 mm. wide), in the very short, few-flowered inflorescence, and in the flowers being almost unspotted or in possessing fewer, smaller and paler spots.

LILIUM DAVIDI VAR. UNICOLOR.

By A. D. COTTON.

FOR some years a Lily of the *L. Davidi* series, characterized by pale-instead of dark-spotted flowers, has been grown under various names in English gardens. For a time it passed under the erroneous name of *L. sutchuenense*, but latterly it has been known as *L. Willmottiae* var. *unicolor*. It is also occasionally found under the more correct name used in the heading to this article. Being a very good garden Lily the plant has received some attention in the horticultural press, but it has never been dealt with by a British botanist. As shown below, however, it was accurately described by Prof. EUGENIO BARONI of Florence under the name *L. Biondii*. Though it is often spoken of as an unspotted Lily, careful observation shows that small, red spots of varying hue are always present. Sufficient data are now available for the provision of a detailed account, for reviewing the systematic position, and settling the question of the name.

HISTORY OF THE PRESENT STOCK.—It will be more convenient to trace the history of the plant as known to the English and Dutch before dealing with the specimens described by BARONI. The name proposed by the Italian botanist was, unfortunately, owing to its having been regarded by WILSON as a synonym, completely lost to the gardening public and to a large extent to botanists.

The Lily was first exhibited in this country by Messrs. R. WALLACE in 1932 under the name *L. sutchuenense*. It came into prominence at the Lily Conference of 1933, where it was again shown by Messrs. WALLACE and also by Messrs. CONSTABLE. At one of the discussions at that Conference Mr. JOHN HOOG of the firm of VAN TUBERGEN of Haarlem, remarked, "A most distinct Lily a few years ago made its appearance in a Dutch nursery, origin unknown, and has been exhibited since at Haarlem under the name of *L. sutchuenense*. It is *L. Willmottiae*, but the flowers are larger and unspotted. I have the newcomer now growing under the name of *L. Willmottiae unicolor*; it is certainly a very great addition to our cultivated Lilies." (Lily Year-Book, 1933, 139.)

A few months later the Lily was illustrated by a coloured plate in the Gardeners' Chronicle (Feb. 3, 1934, p. 72). It was stated to be one of the outstanding species at the Lily Conference, and it was pointed out that though the plate bore the name *L. sutchuenense* the plant might prove to be a form of *L. Davidi* or of *L. Willmottiae*. This notice elicited a rejoinder by Mr. HOOG, who, after protesting against the use of the name *L. sutchuenense*, added: "This unspotted form first made its appearance in Holland two years ago, at one of the weekly meetings of the General Bulb Growers' Society of Haarlem, where

it was stated to have been raised from seeds sent home by a missionary in China. Clearly it is nothing but a local variety of *L. Willmottiae*, which, as WILSON states, is found growing wild over a considerable area in central China, and I propose it should be called *L. Willmottiae* var. *unicolor*" (loc. cit. March 3, 1934, p. 145).

It may be pointed out in passing that, as shown on page 26, the true *L. sutchuenense* is heavily marked with dark spots. It is in fact identical with *L. Willmottiae* (= *L. Davidi* var. *Willmottiae* according to the revised classification). Mr. HOOG's criticism of the use of the name *L. sutchuenense* was, therefore, justified, as was also his suggestion that the new Lily should be given the status of a distinct variety.

The following year the Lily was exhibited at Chelsea. The name *L. sutchuenense*, however, died hard, and the plant passed as this species for several seasons. In his catalogue for 1934 Mr. WALLACE listed *L. Willmottiae* var. *unicolor* and thus refers to it, "Introduced from Mongolia in 1912 and first exhibited in this country by us in 1932, this beautiful Lily has been the subject of much controversy. It is said by some authorities to be a geographical form of *L. Davidi* or *L. Willmottiae*; it is, however, quite distinct from either, though of the two it more closely resembles *L. Willmottiae*. The colour of the flowers is richer, being a glowing vermillion-orange, with very tiny, scattered, dark spots towards the centre of the flower, often unspotted." Mr. CONSTABLE's catalogue (1935) adds further details, "In 1912 a bulb of this Lily was given to the late Mr. R. VAN DER SCHOOT by a Catholic priest, the son of a bulb-grower, who found it in Mongolia. From this particular bulb springs the stock now offered for distribution." It was illustrated by an excellent photograph (p. 68).

By this time the plant had become notorious, but its precise provenance remained obscure. A letter was, therefore, sent recently to Mr. HOOG, asking if details on this point were available. In the course of his reply Mr. HOOG wrote, "This Lily was first exhibited by the late Mr. R. A. VAN DER SCHOOT, who stated to have received it from Central China. No other information is available or could be got."

* * * *

THE EARLIER ITALIAN STOCK.—We are now in a position to consider the Lily described by Prof. BARONI as *L. Biondii* (Nuov. Giorn. Bot. Ital. N.S. ii, 337, tt. viii & ix, Nov. 1895). It was clearly a species belonging to the *L. Davidi* series and the account, which emphasizes the presence of brick red spots on the flower instead of the characteristic purple black spots, was accompanied by a coloured plate depicting a single, pale orange-red flower marked with reddish spots. On evidence which is explained below, WILSON concluded that this plant was a synonym of *L. Davidi* (The Lilies of Eastern Asia, p. 81). As his decision was not convincing, a request was forwarded early this year to Prof. R. P. SERMOLLI, the Keeper of the Florence Herbarium, asking for the loan of the original specimens. In response two sheets (specimen Nos. 16542 and 6848) were kindly sent to Kew.

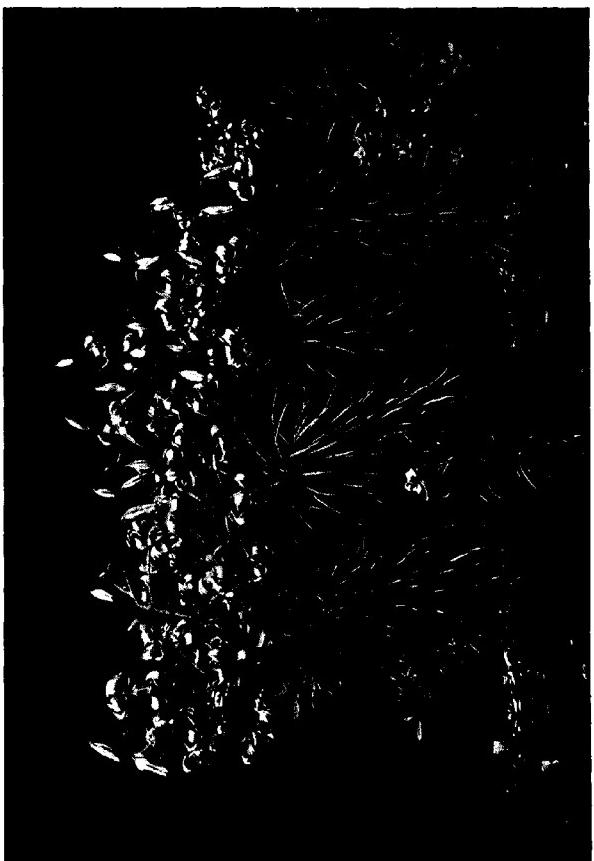


FIG. 10.—*LILIUUM DAVIDII* IN MR. GROVE'S GARDEN.

[To face p. 36.



FIG. 11.—*LILIUM × SHUKSAN* IN MR. STERN'S GARDEN, JULY, 1938.

6 FT. 9 IN. HIGH.

BARONI's specimens were obtained from bulbs sent by Padre GIUSEPPE GIRALDI from Shensi and grown in the Botanic Garden at Florence. The Lily was named after ANTONIO BIONDI, a patron of botany. The labels show that specimen No. 16542 was gathered at Florence in June, 1898, derived from a bulb collected on the "Thae-pe-chan" range in February, 1894. It consists of a stout stem with several flowers. The bulb of No. 6848 was collected in In-kia-po in April, 1895, and the actual specimen, which flowered at Florence in June, 1897, represents a single-flowered shoot. Both the Chinese localities are in southern Shensi.* BARONI states that his new species flowered in the Florence Botanic Garden in June, 1895. In a note published two years later he remarks that the Lily had flowered again, and that he still regarded it as a distinct species (loc. cit. iv. 304, July 1897).

It will be observed that there is a discrepancy in the dates, since BARONI's first paper antedates by three and two years respectively the date of flowering cited on the sheets. It is obvious, therefore, that these sheets do not represent the actual specimens from which the species was described. As there are no other sheets of this species in the Florence Herbarium the most probable solution is that the actual specimen used for the description was dissected for the purpose of illustration and was not considered worth preserving, but that two and three years later shoots were cut from the same bulb (or bulbs) and incorporated in the herbarium.

The discrepancy does not, however, affect the issue, as the existing sheets agree so well with the description and illustration that they may be accepted as authentic and may be used to amplify the description. As Thae-pe-chan is the only locality cited by BARONI, No. 16542 must be considered as the type specimen. The flowers of this number show the reddish spots, and the short, stiff stem bears numerous, rather long and very narrow leaves. These features also characterize *L. Davidi* var. *unicolor*, and there can be no doubt that *L. Biondii* represents the same plant. The sheets from the Florence Herbarium are of particular interest in that they supply the first information as to native habitat.†

* These localities are now spelled T'ai pai shan and Yin-kia pu. They are not to be found in The Times Atlas, but the Curator of Maps of the Royal Geographical Society informs me that they lie almost exactly on the parallel of latitude 34° N. It will thus be seen that they are in southern Shensi and not Northern Shensi as was stated by BARONI, being, in fact, less than 150 miles from the Szechwan boundary.

† The climax of this discovery—reached after the present article was complete—was the receipt of a letter from Professor SERMOLLI saying that plants of *L. Biondii* still survived at Florence, and that they were about to flower. This was followed a month later by a parcel (forwarded by express post) containing three flowering stems. In every particular these agreed with var. *unicolor*, a fact which was confirmed by Mr. GROVE and Mr. H. COMBER, to whom the specimens were shown. Warm thanks are due to Professor SERMOLLI for his courtesy and public-spirited action.

An even more convincing proof of their identity was obtained later. Mr. COMBER tested the pollen of the Florence plants on stigmas of 6 flowers of var. *unicolor* growing under glass at Burnham. No fertilization followed. This is almost conclusive evidence that the two plants are not only identical, but that they represent the same clone.

Nearly 20 years after the publication of BÁRONI's paper an Award of Merit was granted by the Royal Horticultural Society to a Lily exhibited under the name *L. Biondii*. This was shown by the late Mr. AMOS PERRY senior at a meeting on September 8, 1914, and a note on the plant with a photograph was published in the Gardeners' Magazine (1914, pp. 693, 703). The flowers were said to be "scarlet, spotted with black." The same figure appeared later in the account published in the Journal of the R.H.S. (vol. 40, p. cxii, fig. 112, April 1915). The present Mr. AMOS PERRY informs me in a recent letter that the bulbs in question formed part of a large consignment purchased by his father from Protheroe and Morris, and that a note made at the time runs, "flowers are copiously spotted down the face of the perianth segments with dark, nearly black markings." With such unmistakable evidence as to the presence of large black spots it is clear that the identification was erroneous.

WILSON's view that *L. Biondii* was merely a synonym of *L. Davidii* was based, apparently, entirely on PERRY'S stock. He writes, "In 1922 I saw growing in English gardens bulbs distributed by MESSRS. BEES as "L. pseudo-tigrinum," and others sent out by AMOS PERRY & Co. as "L. Biondii." These Lilies were in flower and were unquestionably *L. Davidii*" (Lilies of Eastern Asia, p. 83). As regards these specimens this conclusion was probably correct, but as shown above the *L. Biondii* examined was not the true plant. It was unlike WILSON to rely on specimens seen in gardens without documentary support, but there is no evidence that he ever saw the Florence plants or authentic material. Had *L. Biondii*, which had been illustrated in colour and so well described, been given its proper status in Lilies of Eastern Asia it would have been recognized at once when the Lily was re-introduced by MESSRS. VAN TUBERGEN.

* * * *

GEOGRAPHICAL DISTRIBUTION.—Efforts have been made to ascertain the further geographical range of the Lily by examination of collections in the large herbaria of the world. The material in the herbaria of Kew and the British Museum has been searched and also that of Edinburgh, Harvard University and the New York Botanical Garden, which has been kindly sent to Kew on loan, whilst Prof. H. HUMBERT, Dr. L. DIELS and Dr. H. HANDEL-MAZZETTI have been good enough to examine the collections under their charge at Paris, Berlin and Vienna respectively. With the exception of a single and rather doubtful specimen in the New York herbarium collected by ROCK (No. 12592 A) in south-western Kansu no further wild specimens of var. *unicolor* have been detected. In the Kew herbarium there is an unspotted specimen communicated by MESSRS. VEITCH in 1905, grown from bulbs forwarded by WILSON from China. No locality is recorded, but the bulbs were presumably collected during WILSON's 1903-05 expedition for that firm, when he worked almost exclusively in Szechwan. As far as is known, therefore, the distribution of the

variety is confined to southern Shensi, though it may extend to Szechwan and southern Kansu. It has been introduced to Europe on three occasions as evidenced by the specimens cultivated at Florence (1895), those grown by Messrs. VEITCH (1905), and those shown recently at Haarlem by Mr. VAN DER SCHOOT from which our present stock is derived.

* * * *

GENERAL DESCRIPTION, STATUS AND NAME.—A feature which is at once apparent with regard to the present plant (allowance being made for differences in age and conditions of cultivation) is its singular uniformity and constancy. As the entire stock is believed to be derived from one importation, and probably represents a single clone, this is not remarkable. Cross pollination with allied forms is, however, inevitable in gardens and the usual crop of varying seedlings must before long be expected.

Though the most obvious feature is the pale flowers with small, reddish or pale purple spots, from the botanical standpoint the peculiarities of the stem, foliage and inflorescence are more significant. The short, almost stumpy stem, seldom more than 3 ft. high, exceptionally densely clothed up to the flowers with long, narrow leaves, distinguishes it from other Lilies of the series. The leaves of *L. Davidi* are narrow but shorter, and those of var. *Willmottiae* are long but broader. In both they are darker in colour. The flower-bearing portion of the stem of var. *unicolor* is also short, and bears comparatively few flowers (usually 10-15) which are closely set. The inflorescence does not show the tendency to unlimited elongation as do those of *L. Davidi* and var. *Willmottiae*. This dwarf habit, which is one of the most characteristic features of the Lily, is due to exceedingly short internodes (the number of leaves on an inch of stem is greater than in any of its allies) and suggests origin by a mutation.

As to colour, the flowers are of a peculiar shade of red.* The lack of deep purple pigment (anthocyanin) in the spots, extends to the papillae found towards the base of the floral segments. In the present Lily all these are pale, whereas in its black-spotted allies the dark pigment is also found, in a varying extent, in the upper papillae. The deficiency of anthocyanin may also account for the paler colour of the leaves, and for the stem being less heavily speckled with purple brown. The suppression of a dark pigment is not uncommon in Lilies, a close parallel with the present case being found in *L. chalcedonicum* (only here the non-spotted or very pale-spotted form happens to have been first described and is therefore regarded as the species proper). Great variation in the amount of spotting and pigment development is well-known in other Lilies, such as *L. Bakerianum*, *L. monadelphum* and *L. ochraceum*.

L. Davidi var. *unicolor* is self-sterile, a fact which is not surprising if the plant consists of a single clone. *Intra-clonal* sterility is fre-

* Rouge brasier No. 1, of Oberthür's Répertoire de Couleurs.

quent, and probably the general rule amongst Lilies. If a planting consists of more than one clone, however, seed-production usually follows showing that *inter-clonal* crossing has taken place.

The idea has been hazarded that the Lily may represent a hybrid. In order to obtain an opinion on this point, specimens were sent to Dr. C. D. DARLINGTON of the John Innes Horticultural Institution, who kindly offered to examine the plants cytologically. He reports that an examination of the first division of the nuclei of the pollen mother cells shows that the plant is not a first generation cross between two species. More than this he is not prepared to say. There is no evidence to support the theory, and all that can be said at present is that the variety is found in the wild state in China.

As to its taxonomic status the characters shown by the stem, leaves and inflorescence, though definite, cannot be regarded as being of sufficient importance to merit specific rank, and the suppression of pigment development is of even less taxonomic significance. The varietal rank suggested by Mr. HOOG is amply justified, but as there is no evidence that the plant is genetically related to var. *Willmottiae*, there is no reason for not following the normal course and regarding it as a variety of the species itself (i.e. of *L. Davidi*).

The International Rules give clear guidance as to the name to be employed. If the plant were accepted as a species it would be necessary to retain the specific name *L. Biondii*. Being a variety, however, it is incumbent to employ the first varietal epithet already in existence. Though a formal description of the Lily as a variety has never been published, its identity had been made clear under the varietal epithet *unicolor*, and that name, being validly published, must be adopted.

As a garden Lily *L. Davidi* var. *unicolor* promises to be of considerable value. It has three merits—its compact non-running habit, its short stems which need no stakes, and its vigour and persistence in many gardens where its close relatives do not thrive. On the light soil of Kew the plant lasts much better than var. *Willmottiae*, and Mr. P. ROSENHEIM has the same experience on his light, gravelly soil of neutral reaction. In an article in the Journal of the R.H.S. (vol. 63, p. 230) Mr. GROVE, whose bulbs were obtained direct from Mr. HOOG, states that it has done well with him for 4 years and has an astonishing power of bulblet production at the base of the stem. It thrives also with Professor LYTTLE on acid peat, and with Col. C. H. GREY on the slightly acid soil of Hocker Edge. On calcareous soils it is less happy. Mr. ROBERT DIMSDALE writes that though *L. Davidi* does well and var. *Willmottiae* fairly well, on the oolitic limestone of Lechlade, "var. *unicolor* does not like my very calcareous soil." In Major STERN's garden also the Lily does not flourish.

The shoots of the present variety have been stated to arise directly from the bulb, and not to develop horizontally in a stoloniform manner, but Mr. H. F. COMBER informs me that this is not the case with young bulbs for if small bulbs are planted out in lines in the

autumn, the rows in the following spring are far from regular. The "running," however, is considerably less than in *L. Davidi* or var. *Willmottiae*. If good sized bulbs are planted, from the garden point of view the Lily "stays put."

The excellent photograph (fig. 10) illustrating this article was kindly supplied by Mr. GROVE.

DIAGNOSIS, SYNONYMY AND REFERENCES.

- LILUM DAVIDI var. UNICOLOR (Hort. van Tubergen) Cotton, comb. nov. A forma typica caule breviora usque 1 m. tantum alto, foliis longioribus confertissimis linearibus (2-4 mm. latis), floribus paucioribus punctis minoribus pallidis vel saturate rubris haud nigris distincta.
 Hab.: Shensi? Kansu? Szechwan?
 L. WILLMOTTIAE var. UNICOLOR Hort. van Tubergen, Hoog in R.H.S. Lily Year-Book, 1933, 139; in Gard. Chron., March 3, 1934, 145. Grove in Journ. Roy. Hort. Soc., Ixiii, 230, April, 1938.
 L. BIONDI Baroni in Nuov Giorn. Bot. Ital., n.s. II. 337, tt. 8-9 (1895); in IV. 304 (1897). Anon. in Gard. Chron., Dec. 21, 1895, 745.
 L. PAPILLIFERUM Franch. sec. Baker in Journ. Roy. Hort. Soc. xxvi. 342, Dec. 1901, quoad synon., *L. Biondi* Baroni tantum, non Franchet.
 L. SUTCHUENENSE Anon. in Gard. Chron., Feb. 3, 1934, 72, non Franchet; Woodcock and Coutts, Lilies, p. 195 (Constable's plant only) 1935.

DISCUSSIONS AT MEETINGS OF THE LILY GROUP

I. HYBRID LILIES.

October 26, 1937: F. C. STERN, F.L.S., in the Chair.

The CHAIRMAN: In our Group Meeting this afternoon we are to discuss Hybrid Lilies, and Mr. COMBER and Colonel NAPIER are opening the discussion. Afterwards I hope many members will tell us of their experiences with the hybrid Lilies they are trying to produce.

Some people have found fault with us, because as a Group we have been rather keen on producing Lily hybrids; they do not think that anything finer than the species can be produced; we feel there is no harm in trying. There are two or three really first-class hybrids; I am confident if we go on we shall have some even better ones in the future.

Before I ask these two gentlemen to speak, I want to announce that I have here a lot of Lily seeds which kind people have sent us to distribute. Dr. STOKER has sent a good many envelopes of *L. Duchartrei*, lately known as *Farreri*. Mr. R. D. TROTTER has sent us seed saved from plants obtained from white Martagon Lilies crossed with *L. × Marhan 'Ellen Willmott'*. Some of you will remember the fine range of Martagon hybrids which he brought up to the Hall. Mr. SIMMONDS will be pleased to distribute any of the envelopes on application.

I will now ask Colonel NAPIER to open the discussion.

Colonel NAPIER: I must start by explaining that I cannot lay claim to being a scientific plant breeder, and that I am afraid that I have never mastered the Mendelian laws or the intricacies of chromosomes.

However, before commencing to hybridize, it is as well to consider what one desires to produce. To my mind hybridizing should aim at one of two objects: either to produce a still more beautiful variety or to produce a hardier or more robust form of an existing variety.

For instance, I tried to transmit some of the constitution of *L. regale* into *L. longiflorum* and made the cross both ways. I failed to get viable seed from *L. longiflorum* fertilized with *L. regale* pollen, while *L. regale* fertilized with *L. longiflorum* pollen merely produced *L. regale*. Some Lilies appear to lend themselves more readily to the production of hybrids than others; under this heading I might mention *L. Hansonii*, *L. Davidi Willmottiae* and *L. pardalinum*.

I once had seed sent me of a *L. regale* \times *L. Rœzlíi* cross. I never imagined that it would be of any use, but I sowed and flowered it, and as I had expected the result was a debilitated *L. regale* only fit for the scrapheap.

All the American Lilies cross easily, and *L. pardalinum* crossed with *L. Parryi* pollen produces a very fine hybrid.

I consider my best effort to be a cross I made between *L. pardalinum* and *L. parvum luteum*. It bears a full-sized *pardalinum* flower of a clear golden yellow very faintly spotted. I called it 'Golden Pard.'

I also tried crossing *L. pardalinum* with *L. superbum* and *L. Rœzlíi*, but the resultant hybrids were not to my mind worth growing.

Hybridizing Lilies demands a lot of patience as, besides the long wait until one can see the results of the cross, my experience is that in three times out of four the Lily is indistinguishable from the seed parent.

I once crossed *L. Duchartrei* with *L. Wardii*, and when a huge capsule formed nearly treble the normal size, I felt sure I had got something good. In due course the seedlings flowered and were indistinguishable from *L. Duchartrei*.

This happened to me, too, when crossing *Fritillaria Meleagris alba* with *F. recurva*. I had hoped for a scarlet Meleagris, but I merely got *F. Meleagris alba*.

I had a stroke of bad luck this year. A row of 1932 seedlings of *L. pyrenaicum rubrum* crossed with *L. pomponium* was just coming into flower when a young rabbit got in and bit the tops off all the row in one night.

I must now wait another year to see the result of my cross.

Mr. H. COMBER: We all know how a Lily cross is made; you just take an anther of one Lily and transfer its pollen to the stigma of another and hope for the best.

Several interesting things may then happen. The first and commonest is nothing: the pod dies. It may grow for a time and then fail, or it may contain a few seeds and much chaff.

The seeds may or may not contain embryos. I have even seen pods grow to full size and ripen normally in every respect, but contain nothing but chaff. This was with *L. formosanum* Pricei pollinated with *L. Brownii* (type).

On the other hand a large pod full of good seeds is often too good to be true.

Experience teaches that in many Lilies a phenomenon known as apomixis or parthenogenesis regularly takes place, and this in more than one way. Although pollination by a certain other species produces the stimulus for seed production, no fusion of gametes occurs.

The result is that all the seedlings may be identical with the mother, or that all may vary from her within the usual limits of the mother species.

This has a most important bearing on our subject. I feel con-

fident that many so-called Lily hybrids are nothing more than natural varieties of the seed parent, and would have been obtained by self-pollination.

A prominent example of this is *L. pumilum* 'Golden Gleam,' which we now know to be simply a chance 'albino' form. Perhaps albino is not a very good word, as red Lilies change to yellow, not to white.

That 'Golden Gleam' occurred among the seedlings of a cross made in good faith between *L. pumilum* and *L. Martagon album* is not questioned, but what is believed to be the same Lily has also been found wild in Korea (which is the home of typical *L. pumilum*) and named *L. chrysanthum* by Nakai.

It therefore is obvious that the white Martagon in this case only stimulated the production of seeds, but no actual fusion of the gametes took place, and 'Golden Gleam' was one in a thousand, just as it might have arisen among any other sowing of plain *L. pumilum* seed.

Many of us who have used *L. regale* as the seed parent in a cross can corroborate this. And it is no earthly use carrying on the cross to the second generation, for the male parent simply isn't in it!

For this reason it is advisable to make Lily crosses both ways.

On the other hand, to obtain full advantage of them, all successful crosses should be cross-pollinated amongst themselves.

Prominent examples of this are our present day races of Crow's Hybrids, coming into flower weeks after *L. regale*, and presenting an enormous variety of shapely sweet-scented flowers in an infinity of shades of colour. In this case all are superior to *L. regale*.

Similarly Mr. STOOKE has produced a host of *Willcrovidi* and *Cromottiae* seedlings of tremendous vigour, and with us this year seedlings from them again are outstripping in growth all others of the *L. Willmottiae* group.

'Maxwill' is another extraordinary and vigorous hybrid, which, however, comes true from seed.

Seeds may sometimes be produced from a self-sterile hybrid by using pollen from another Lily, and yet this other Lily has no part in the make-up of the progeny. This seems to be the case with *Scottiae* and some of the forms of *L. dauricum*.

Scottiae is another very vigorous hybrid and most prolific of vigorous forms in the second generation. I show nine months old seedlings tonight. Incidentally I have this year flowered the same thing from *Scottiae* selfed as from *Scottiae* crossed by a large yellow *Thunbergianum*.

It is interesting to come back to a cross which has taken fully. At Burnham we have recently raised another new hybrid Lily of considerable importance from the point of view of improvement of existing forms. *L. Willmottiae* is a lovely thing, but it does need support. *L. Willmottiae unicolor* has more shapely flowers of purer colour and a stiff stem, but it cannot be grown so tall nor will it carry



FIG. 12.—*LILJUM PARRYI* AND *L. BROWNII* IN THE HON. MRS.
SPENDER CLAY'S GARDEN.



FIG. 13.—LILUM X CORONATION.

[To face p. 45.]

so many flowers as *Willmottiae* itself. Now, in an apparently most unexciting cross between these two we have combined all the good points and added another ; that is exceptional vigour. Even on our poor hungry gravel soil at Burnham the hybrid has in three years produced larger bulbs than I have ever seen in any of the *L. Willmottiae* group. *L. × burnhamense*, our cross between *L. neilgherrense* and *L. Wallichianum* was a good cross which took every time ; all seedlings of it were practically identical. Many of the crimson marked forms of *L. auratum* have at various times been regarded as hybrids but it is known that they crop up freely among wild imported bulbs, and also among seedlings raised from parents of normal colour.

With the exception of *L. × Parkmannii*, which had *L. speciosum* as a seed parent, it seems quite possible that these magnificent plants are nothing more than superb forms of *L. auratum*.

Again, take that wonderful plant *L. pardalinum*, hardy, healthy and a good grower, and we all think we know it. Yet there are literally scores of forms of it, some in cultivation, named and unnamed, many others described to us by correspondents abroad—all Lilies with the same creeping rhizome—few agreeing exactly with the plants we know.

Some extreme forms have been distinguished as species under the names of *L. nevadense* and *L. Roezlii*. They are all good plants whatever the name, but if an unfamiliar one crops up it is all too frequently dubbed hybrid perhaps because it is easier than admitting our ignorance of the extent of specific variation.

The CHAIRMAN : I hope somebody will join in further discussion, telling us what they have done in their own gardens with any other hybrids that have not been mentioned. Colonel NAPIER and Mr. COMBER will be pleased to answer any questions.

I would just start the ball rolling by saying a few things on the different hybrids I am trying to grow which have not been mentioned yet. I always feel if we could get *L. Henryi* crossed on to other things it would be an improvement, because the flowers of *L. Henryi* are rather small for the size of the plant ; if we got some big yellow flowers on this Lily, it would be a magnificent thing. In my opinion, as it is, it is not first-rate. *L. Henryi* will grow on any soil except pure peat ; even on my chalky soil it grows very tall. Perhaps Mr. WALLACE will tell us about *L. Henryi citrinum*, whether that is a hybrid, or a form that has just appeared. It is an extremely nice plant and an easy grower. We have some hybrids that have been made in America by crossing, so it is said, *L. myriophyllum superbum* and *L. tigrinum*. One, known as "T. A. Havemeyer," was shown by Mr. WALLACE and is a most beautiful thing ; I think it is a cross with *Henryi*, because the leaves are very like the leaves of *Henryi*. It should be a first-class plant.

An American friend of mine sent me two bulbs. I have planted them both, and one, sent under the name of "Sultig," was even a better thing than the one called "T. A. Havemeyer" ; it was

a stronger grower, and the leaves were rather more like *L. myriophyllum superbum*. If this becomes a good garden plant it will be an improvement on *L. Henryi*.

Then there is another plant which I am very fond of which has not been mentioned, called "G. C. Creelman"; it was a cross made by Miss PRESTON, and was supposed to be *L. Sargentiae* crossed *L. regale*. It is a most lovely plant; the only fault in it is that the flowers are a little bit too near together on the flowerhead. It is curious that this hybrid grows almost stronger than any Lily I grow, yet *L. Sargentiae* will not grow on chalk; I have never succeeded in growing the latter where there is lime. I often wonder whether it is a *Sargentiae* cross; it has no bulbils as one would suppose a cross with *L. Sargentiae* would have.

Then there is one called *aurelianense*, made by M. E. DEBRAS in France, a cross of *L. Henryi* and *L. Sargentiae*; that flowered with me this year for the first time; I only had a small bulbil some years ago; it was not very good, perhaps it will improve.

There are several other Americans, "Pride of Charlotte," and a Lily called "Mystic," which I do not believe is a hybrid at all. It is a lovely thing and very difficult to grow. It was once shown by Mr. WALLACE.

Mr. COMBER mentioned the *pardalinum* and *Humboldtii* hybrids, and some are magnificent. There is one called "Shuksan," an easy grower which grows six or seven feet and is most magnificent (fig. 11). I like that the best of those I have tried. Miss PRESTON is an indefatigable hybridist, and very kind in distributing all the hybrids that she produces. She has been making a lot of experiments with *L. Willmottiae* crossed with *dauricum*. She sent me a whole set of them; 'Lyla McCann' is magnificent, a really first-class plant, and the other called 'Coronation' (fig. 12), a fine yellow-flowered Lily.

Mr. FRANK JONES made a cross of *L. candidum* and *L. chalcedonicum*, producing *L. × testaceum*. There was a photograph of this cross in the Lily Year-Book. He also crossed *L. chalcedonicum maculatum* and *L. candidum*; these have come quite different; he sent me some seedlings. They flowered last year; they are a light form of *L. chalcedonicum*, perhaps a dark pink, not a red.

Col. NAPIER said from *L. Duchartrei* crossed with *L. Wardii* he got plants that were exactly the same as *L. Duchartrei*. I wonder whether he would have got something different in the second generation if he had taken seed and selfed it. I am going to ask Mr. COTTON this question later on.

I was surprised to hear from Mr. COMBER that *L. Roezlii* was merely a form of *pardalinum*.

Mr. COMBER: They are all in the same group and it depends on a person's opinion as to whether he separates or lumps them.

The CHAIRMAN: You would not think that was a true species?

Mr. COMBER: It entirely depends upon the point of view—they are very close.

The CHAIRMAN : Mr. ROSE, will you tell us your experiences.

Mr. ROSE : I am afraid I can add but very little to the knowledge of this meeting, because I have never studied the real art of plant-breeding. I did not interest myself in hybrid Lilies until recently ; I was of the opinion, as probably most other Lily growers were, that the species were far more beautiful and much to be preferred to any hybrids. I know this view was shared by some. I remember Mr. WALLACE in a lecture some twelve or fourteen years ago was very emphatic in his view on this matter. But I must confess that recently my views have changed. They had to, seeing the number of fine hybrids that are to be seen to-day. I think it quite possible in years to come that hybrid Lilies will be as numerous as Rhododendrons are to-day, though I hope there will not be so many dud hybrids perpetuated. I think if one can produce a hybrid Lily which for shape and form is better than its parent, then good work has undoubtedly been done. Everybody would probably agree with the Chairman that 'G. C. Creelman' is a superior plant to either *L. regale* or *L. Sargentiae*. I think myself that *Davmottiae* is a superior plant to either *Davidi* or *Willmottiae*, and there are of course plenty of others.

Up to the present year I had confined myself to the Martagon family only for hybridizing, and I used not only the species, but also the hybrids which had been raised previously by others. The result was very gratifying, and several of the hybrids which we have raised from Martagons are really good. Col. NAPIER kindly sent me some bulbs of that very beautiful hybrid which he raised of *L. pardalinum* and *L. Parryi*. They flowered this year, and it really is first-class. He also sent *L. pardalinum* \times *superbum*. That did not flower this year, but made good growth. I am horribly disappointed to hear him say it is no good.

I have also got some seedlings growing of *L. parvum* \times *L. Parryi*, and *L. Parryi* \times *Duchartrei* from seed which Dr. STOKER sent me. These will probably flower next year, and I am looking forward to them with much interest.

Dr. STOKER also sent me *candidum* crossed \times *testaceum*. I was only successful in raising one plant ; I am looking forward to the result of that one bulb.

Then this year we set ourselves out to do some hybridizing with other species, but as I said at the beginning of this short speech I am not a plant-breeder from a scientific point of view, so that some of the crosses I have made may be more amusing than helpful to our members. I crossed *L. Parryi* with *L. Szovitsianum*, *L. Willmottiae* with *L. testaceum*, and *L. Willmottiae* with *L. amabile luteum*, *L. Bolanderi* with *L. rubescens*, *L. Szovitsianum* with *L. amabile luteum*, the hybrid Martagon 'Mary Swaythling' with *L. amabile luteum*, *L. Willmottiae* with *L. Szovitsianum*, *L. pardalinum* with *L. Washingtonianum*, *L. Parryi* with *L. Humboldtii magnificum*, and *L. Parryi* with *L. amabile luteum*, *L. Washingtonianum* with *L. amabile luteum*,

and *L. pardalinum* with *L. Parryi*, *L. Washingtonianum* and *L. pardalinum*, *L. amabile* with *L. × 'Kulshan'*, and *L. rubescens* with *L. regale*.

We have some seed which appears at any rate to be real fertile seed from all these crosses, and it has already been sown.

Experience in raising hybrid Rhododendrons, of which I have had a good deal has taught me that by crossing two species of the same colour it is possible to raise hybrids of similar colour to the parents, but more floriferous, hardier and easier grown plants. Assuming in Lilies that similar results may be obtained, and I am successful in raising plants from the hybrids I have made, then I think we may expect something good from *L. Szovitsianum* crossed with *L. amabile luteum*, *L. Parryi* with *L. Szovitsianum*, the yellow hybrid 'Mary Swaythling' with *L. amabile luteum*, and *L. Willmottiae* with the *L. amabile* type.

My experience with these crosses has been similar to that of Mr. STOOKE, that is, the number of fertile seeds from many of the crosses of species is very small. In some of these crosses that I have used although the pod of seed seemed very large, by careful examination I found there were not more than four, five or six fertile seeds, the rest was only chaff.

I only regret that I have such little time to spend on the matter, but I am hoping with these crosses to find something which may be of interest.

Dr. AMSLER : After Mr. ROSE has told you he has not done much in the way of hybridizing, I do not think I ought to get up and say anything, but some years ago I did think that I had got a better Lily. I tried to cross *L. leucanthum centifolium* with *L. regale*. *L. leucanthum centifolium* is a magnificent thing, and very few people except our Chairman grow it well. To my delight I got two fertile pods from *L. leucanthum centifolium*, the female parent. In that case the pods were full of seed, I had plenty and gave some away ; I grew a lot of seedlings which flowered quite well at Eton, but the results left me rather cold. They did not seem to be much improvement on *L. regale*, though rather taller ; in their third year they were about three feet high. I then moved to my present garden at Hawkhurst and they have rather gone back ; three or four-year old bulbs do not like being moved, but I cannot say that these plants are any different from ordinary *L. regale* ; in fact, I brought some with two buds on each to our meeting last summer, and both Mr. RAFFILL and Mr. ROSE were rather rude about them ! My pedigree is right, because the *L. leucanthum centifolium* plant was flowered in a pot indoors. It had been given to me by our Chairman, who is always very generous to us, and it cannot have been self-fertilized because de-antherized ; as I said, the hybrid looked exactly like *L. regale*. I think it must mean that *L. regale* is a very dominant type. Nothing else can explain it ; it cannot be a case of parthenogenesis, because we have signs of *regale* only.

I crossed *L. Duchartrei* with *L. Humboldtii*. This is rather an odd cross, and there, like one or two other speakers, I flowered plants which were indistinguishable from *L. Duchartrei*. I suppose it is a case either of parthenogenesis, or pollen blowing about, and the seed was not according to the supposed pedigree.

Col. NAPIER has mentioned 'Princeps'; I think it is the same blood as 'G. C. Creelman.' It is a fine thing, and bears bulbils.

I am glad Col. NAPIER discouraged you from working on *L. pardalinum*. I do not admire these *pardalinum* hybrids, unless we except *pardalinum giganteum*, if that is a hybrid. I think it is a mistake to work on them, for I have seen a large number of hybrids; many of the flowers are very disappointing, especially in their colour, they were a sort of brown-paper colour.

I also tried *L. Brownii* with *L. regale*. I have mentioned before that I have had fertile pods from *L. Brownii* by going elsewhere for my pollen. I never could self-pollinate them. This is outside our subject, but in that case the seedlings came up, lived for a few months, and then died down, and disappeared altogether; the same thing happened with *L. Brownii* crossed *L. regale*. I was delighted to get fertile seed from this cross, and the same thing happened as with *Brownii* seedlings; the seedlings came up, looked quite happy, and then the little leaves died down and when I dug down in the autumn there was nothing left in the pot at all. This is probably due to delicacy, because *L. regale* pollen does not happen to suit *L. Brownii*. I cannot give any other explanation than that.

Our friend Mr. GROVE is always very much against sowing seed from recognized hybrids, because we are liable to get variation. It seems to me this is rather an attraction. I have two pans grown from *testaceum* seed; it is very slow-growing with me, but I think we might quite well get something very interesting from that.

The CHAIRMAN : Were they selfed *testaceum* ?

Dr. AMSLER : Yes, I found two pods on my *testaceum* in 1934, and sowed them, and they are coming on quite nicely, but they are very slow. One statement was made about *L. Sargentiae*; it is not yet proven that *L. Sargentiae* does not like lime. I did not think it did until I saw it growing on the top of a most unusual place on a made up soil in a rock garden at Eton, which is nothing but lime loam and tufa rock stone. It was moved from there to Wentworth, where the soil is ideal, and not only have the old bulbs been lost, but the grower has not flowered the bulbils.

LADY BEATRIX STANLEY : I should like to say that I crossed *L. neilgherrense* with *L. formosanum*. I flowered it when I came back from India, and it has since died. I have got seedlings of *testaceum*; I raised these seedlings and this year I have had seeds on *L. chalcedonicum* which was growing close to *testaceum*; whether they are pure seeds I cannot say, but it is good seed.

Dr. AMSLER : May I ask how you got your *L. neilgherrense*; did you bring the bulbs back ?

LADY BEATRIX STANLEY : I had them in India and brought some home with me.

Dr. AMSLER : A lady brought a lot of *L. neilgherrense* from India and gave them to a friend of mine ; when they came up they were not *L. neilgherrense* at all, they were *L. myriophyllum superbum*.

LADY BEATRIX STANLEY : I was in the Neilgherries. I saw them growing wild in many places. I dug these up myself and put them in the cold greenhouse, planted out.

Mr. WALLACE : What was the flower like ?

LADY BEATRIX STANLEY : It was exactly like *L. neilgherrense*, but the leaves were pure *formosanum*, the flower was a cream colour and very long and no colour on the outside.

Mr. CRAGG. I have only just taken up growing Lilies and am very keen to grow more, and very keen to know something about hybrids, but anybody who starts to raise hybrids is working very much in the dark. I should like to make a suggestion for the consideration of your Lily Committee : that this group should be turned into an experimental group and that each year we should be given something to do; some crosses to make, so that we can get something which can be tabulated. All this work is going on and probably it is left and nobody knows anything about it ; it is only by putting all our heads together that we shall get on quickly. I want to raise some hybrids ; the time left to me to carry on the work is not any too long, so I want to get to work quickly. I think we should put our heads together and pass our knowledge on to headquarters, where it can be tabulated and the results disseminated.

This would save people going on with the same sort of work which is useless and we would make a very great stride forward in a much shorter time than has been done at present.

I have raised a good many Chrysanthemums of a market type. I always try to combine flower, colour, stem and foliage into one whole. In making a cross I have very often found that a plant which had no decent flowers at all had all the other requirements, and I used to cross back on this. This may be applicable to the Lily. Your first result may not be good, but when you get your second cross you may find the result of your work.

The CHAIRMAN : That is a very practical suggestion ; thank you very much.

Mr. WHITE : Five years ago I sowed seed of *L. chalcedonicum* crossed with *testaceum* and flowered it this year for the first time. I believe it was called *L. × Beerensii*, but had died out. The flower was shaped very like *L. chalcedonicum*, yellow flushed with red, with brilliant scarlet anthers, but on the small side ; the foliage was almost identical with *chalcedonicum*.

All my own crosses have failed without a single exception.

Mr. C. P. RAFFILL : First of all, with regard to parents for hybridizing, my advice is to use parents which are constitutionally fitted for your own ground. You may not use *L. regale* as a mother, but you can

use it as a father. This parent is dominant, it is a good strong grower and generally adapted to most people's ground, and it is not at all fastidious. Then use again *L. pardalinum* for crossing with American Lilies. It has a good constitution, so has the Chinese *L. Davidi*; that is also good as a parent. *L. Henryi*, too, can be worked on.

I think there is too much being done in regard to crossing many fastidious Lilies. If you use one for colour, use as the mother plant a species which has a real good constitution which will suit other people's ground besides your own. Everybody knows how well *L. pardalinum* will grow and also *L. regale*. If they are worked on as parents, I think myself we should get a much better constitution for our hybrid Lilies.

The numerous varieties of *L. candidum* could be used with Martagons, especially the form that has recently come from Asia Minor. They are all good types, but the black-stemmed one is the best to use for the parent.

Our friend mentioned *L. × Beerensii*, which is the double cross with *L. chalcedonicum*, three-quarters *chalcedonicum*, one quarter *candidum*. This is in cultivation still, I have a few myself; a friend of mine also has a few.

Personally I think too much is being made of crossing; we are getting it into our heads that we shall have to cross in all directions.

With regard to the cross between *L. speciosum* and *L. auratum* I have made many attempts to make that cross myself, and I have had pods on *L. speciosum* from the resulting cross, but there was nothing inside—it was all chaff with no embryos.

I have made dozens of crosses in the past, but all sorts of things happen to young seedlings. You may get your seed or pods and sow them, and if there is anything that comes along it is bound to pick on that particular crossing. If there is a slug about or a weevil it will go to that pot of Lilies. If a man is given to watering he is bound to upset the can into that pot of Lilies just as they are coming up nicely. If your man comes along with a syringe, it is natural he should hit the seedling just as it has first lifted its head; it snaps off at the bottom, and it is good-bye to your Lily. There is many a slip between the crossing of your Lily and its flowering. I have made many attempts myself, and so far this year I have a couple of real nice, hybrid Lilies. One was the result of a cross of *L. candidum* with *L. testaceum*; most of the old hands know what I was doing this for. 'White Knight' was a double cross with *L. candidum* and back with *L. × testaceum*. I did get one bulb out of a batch of seed, but it was not anything like 'White Knight,' it was a beautifully shaped *testaceum* and darker in colour.

Then I obtained a very pretty thing this year from crossing *Scotiae* on to my best form of *L. Davidi*, and it flowered a much richer colour than either parent. You do not always get what you expect in crossing Lilies, but if you are making any crosses with Lilies, use real good parents. Do not cross in all directions just because the spirit moves you, but select your parents carefully for this purpose.

Dr. AMSLER : Would somebody tell us the best way of preserving pollen, because it is rather important to keep the pollen for two or three weeks, or even a month, if one wants to make certain crosses ?

The CHAIRMAN : Mr. WALLACE, will you tell us from your great experience, something about crosses ?

Mr. WALLACE : Endeavouring to follow those who have spoken is difficult, as they have covered such an enormously wide ground.

In the first place I want to ask Mr. ROSE if all he was certain of twelve or fourteen years ago he is still as certain of to-day. I am sure he will allow me to change as time goes on. What I may have said is past history ; we look at things from a different point of view nowadays ; one has to.

Mr. COMBER mentioned in his interesting remarks that the thought many of the so-called hybrids were not really hybrids, but were a selection from the type. I would like to refer for a moment to 'Maxwill,' and would like to place on record that in my opinion there is no *L. Maximowiczii* in it. I think it is a hybrid between the *L. Davidi*, originally imported and sold as *L. pseudo-tigrinum* by BEES and *L. Willmottiae*. Their *L. Davidi* is a plant of a most persistent character and a very long-lived constitution.

In 1910 a friend brought from BEES three bulbs of *L. pseudo-tigrinum* ; he has moved about the country all these years, and I saw in his garden the first week in August a hundred spikes five or six feet high, the true *L. Davidi*. If you look at *L. Davidi* when they are about 3 to 4 feet high, and look at 'Maxwill' at the same time, you will find they are practically identical as far as foliage goes. But those of you who study your bulbs will know there is nothing of *L. Maximowiczii* in the bulb, absolutely nothing, there never was and there never will be. 'Maxwill' flowers very shortly after *L. Willmottiae*. *L. Davidi* flowers a good fortnight to three weeks later. *L. Davidi* will grow 6 to 7 feet high, 'Maxwill,' as we all know, pushes up a rigid, stiff stem like a poker. If it is a hybrid, and not a selection, it is between *L. Davidi* and *L. Willmottiae* ; perhaps I need not be so outspoken as that ; I only say what I believe ; if it is not that it is a selection, but be it what it may, it is a remarkably fine plant. Why I am so struck on its *Davidi* origin is because of its constitution. From those three bulbs of *L. pseudo-tigrinum* planted by my friend in various Lily gardens bulbs have been reproduced year after year, and it is that same constitution you have in your 'Maxwill.' But we will leave 'Maxwill' for the moment.

Mr. RAFFILL referred to 'White Knight.' May I suggest that in next year's Lily-Book we give illustrations of all the really good hybrid Lilies of the past. For instance, 'White Knight' was the most perfect thing I ever saw, and I still have the original photograph. It was a pure white *testaceum* about four feet high. It was raised by the late Professor SCHEUBEL in Germany, and at the same time he sent me the bulbs he sent some scarlet *testaceum* of the same cross, but they went to Mr. HOOGE in Holland, and I believe were lost during the War years.

Prof. SCHEUBEL raised the original cross between *L. myriophyllum superbum* and *L. regale*. This hybrid Lily flowered the second week in August in Germany, and I had a photograph of the original cross, which unfortunately is now lost. Unfortunately the bulbs that came to us from Germany afterwards were the seedlings from that cross. Mr. GROVE has described them as "a race of bastards," and had a great contempt for them. These particular seedlings are still being raised and further selected. I have had some in flower, with the yellow of *L. myriophyllum superbum* three parts down the trumpet. They are very much on the lines of the Shelburne hybrids, but there is more *L. myriophyllum superbum* in them with its long characteristic bud.

I want somebody here to take *L. myriophyllum superbum* when in flower and put *L. regale* on it, and see what happens. *L. myriophyllum superbum* must be a Lily worth using as a parent. Major STERN referred to it crossed *L. Henryi* which I had in flower. I got Dr. AMSLER one day to come and "vet" it for me; it was supposed to be *L. myriophyllum superbum* crossed *L. tigrinum*; we were absolutely certain there was no *tigrinum*, it was entirely different. It is *L. myriophyllum superbum* and *L. Henryi*; it is a vigorous thing; it had incipient bulbs, but because we flowered it they have not developed. Unfortunately there is apparently a great furore about that Lily in America, and I am under an obligation to send every scrap of it back to the States, so we cannot keep it here unless I can prevail upon the people to let me keep a bit.

Mr. COMBER referred to *L. auratum*. I believe we have had only two hybrids from *L. auratum*, namely the original *Parkmannii*, and *L. auratum* × *L. speciosum* which was also raised by Mr. HAYWOOD when he crossed *platyphyllum* and *speciosum Melpomene*. What we call *L. auratum* 'Crimson Queen' I do not think is anything more than a very fine form of *platyphyllum*. I do not think there is any of the *speciosum* blood in it at all.

It was my privilege this summer to be in Mr. STOOKE's garden for about one hour, and I was surprised to see what he has done. He is going to give us a great number of very fine garden plants. The crosses between these *Wilmottiae-croceum* types have produced something far more vigorous than the original plants. He has some more or less three to six feet high from *bulbiferum croceum* and *Wilmottiae* and *Davidi* all mixed up together; they are magnificent in form and colour and apparently of great constitution.

The thing that interested me most in his garden was *tigrinum* crossed with *bulbiferum croceum*; there was a plant of enormous vigour with great stems standing up straight. There was a *tigrinum* cross shown in the Hall in July, a very beautiful flower. They are plants of great promise.

With regard to the 'G. C. Creelman' Lily, somehow I think it is nothing more than a very greatly improved form of *L. regale*. I cannot see any *L. Sargentiae* in it; it flowers before *L. Sargentiae*, and has no bulbils. You gave the credit of that to Miss PRESTON, but I think the credit should be given to Mr. CROW.

Mr. RAFFILL : Miss PRESTON raised it under CROW's supervision.

The CHAIRMAN : It was in Miss PRESTON's garden when it was selected.

Mr. WALLACE : Miss PRESTON wrote me once saying she did not think it was as good as something she had raised. I think the credit goes to Canada for raising this very fine plant; it originated there, I do not think any of us know exactly how.

We ought to give credit to the late Mrs. BACKHOUSE for her hybrids. The Chairman referred to the *pardalinum-Humboldtii* crosses; 'Shuksan' is a most remarkable garden plant, the welding of *Humboldtii* and *pardalinum* has produced a most perfect Lily, of fine constitution, and one that is going to be a good garden plant of the future.

I would ask the Lily Committee to see if they cannot get together these pictures of the best of the hybrid Lilies and publish them in the Lily Year-Book. Some of those raised in the past like 'White Knight' will be an incitement to members to try to get these Lilies back again.

The CHAIRMAN : I think it is a very good idea. I will ask Mr. COTTON to close the discussion; perhaps he will talk about the different hybrids, and tell us why *L. regale* does not form hybrids when it is crossed as the mother parent. Perhaps Mr. COTTON can explain some of these things, and also tell us how we can keep pollen.

Mr. COTTON : It is not easy to say anything definite as to parthenogenesis in Lilies. There are so many records of the mother plant yielding, after being cross-pollinated, a similar offspring to itself, that there seems no question that parthenogenesis (using the term in its widest sense) must occasionally occur. At the same time, it is not clear that strict precautions have always been taken to prevent self-fertilization or fertilization by means of wind—and insect-borne pollen. To secure a cross it is necessary of course to emasculate the flower in good time and to take steps to exclude all stray pollen. Unless this is done there is no guarantee that the supposed cross has been effected.

Mr. PALMER : If you get the pollen on a stigma and the foreign pollen comes on later, does the original pollen get a start? Does there come a point after which the danger of being pollinated by its own pollen is shut off by the presence of the foreign pollen?

Mr. COTTON : I presume it depends largely on the age of the stigma. If ample and suitable pollen is applied when the stigma is in a receptive state, the grains would germinate at once and probably hinder the germination of pollen applied later; but one must bear in mind that a large number of pollen grains are required to produce a full capsule of seed. The germ tube of a pollen grain bears two male nuclei (male gametes), both of which enter the same ovule, one fertilizing the ovum (female gamete). Therefore every fertile seed in a capsule has been fertilized by a separate pollen grain.*

The above is the normal course, but various forms of aberrant

* In the literature on plant breeding the terms "egg," "ovum," "female nucleus" and "female gamete" may, for practical purposes, be taken as synonymous.

development are known to occur in plants. Those interested should consult Dr. STOCT's paper read at the Lily Conference (Lily Year-Book, 1933, p. 142). The production of a large capsule with infertile seed (parthenocarpy) is believed to be due to the stimulus produced by the pollen tubes. These may penetrate to the base of the style and then cease growth, or they may proceed further and discharge the male nuclei, together with a certain amount of cytoplasm. The swelling of the ovary is believed to be due to the stimulus of the cytoplasm, which probably carries with it a growth hormone. Normally, unless there is a fusion of the male and female gametes no fertile seed is produced. The production of fertile seeds by apomixis (i.e., without fusion) does, however, occasionally occur in plants, especially when foreign pollen is used. Such eggs are apparently stimulated to growth by the pollen tube without actual fusion. The offspring would therefore be identical with the mother plant. It is possible that this occurs in Lilies and that Colonel NAPIER's results in crossing *L. regale* with *L. longiflorum* pollen may be explained in this way.

Col. NAPIER : When *L. regale* was the seed parent it produced *L. regale*; when *L. longiflorum* was the seed parent I could get no seed.

Mr. COTTON : One must remember also that most forms of *L. regale* are remarkably self-fertile, and very special care should be taken to exclude its own pollen. It is always important to see the second generation.

Col. NAPIER : I did not enclose the flower, but I always keep it so smothered in pollen that it looks as if there is no room for any other pollen to get in. I tried covering the plant, but I find they are rather liable to mould if it is rainy weather.

Dr. AMSLER : What about a muslin cap; de-antherizing the moment it begins to open while the pollen is still sticky, covering it with a muslin cap and uncovering only while you are fertilizing?

Mr. COTTON : That is where you can easily get mould. I have never done any hybridizing work, and I am sorry I cannot say anything first-hand about keeping pollen.

Mr. CONSTABLE : There are pollen tubes.

The CHAIRMAN : They are apt to get damp, with Daffodils you can keep it about a fortnight in silver paper.

Mr. RAFFILL : We used to keep Chrysanthemum pollen by packing it in cotton wool, then carbide, and then cotton wool again.

Dr. AMSLER : Calcium chloride is strongly hygroscopic and might be better.

Mr. RAFFILL : We keep Orchid pollen in cotton wool and carbide, that absorbs the extra moisture.

Dr. AMSLER : Will it keep a couple of months if you want to hybridize somewhere about late August?

Mr. RAFFILL : I have never tested the longevity of Lily pollen, but I have done it in connexion with Orchid pollen.

Mr. COMBER : I am most interested to hear Mr. WALLACE considers 'Maxwill' is not a hybrid.

Mr. WALLACE : I say *L. Maximowiczii* has nothing to do with it.

Mr. COMBER : That was the view I took up in the Gardeners' Chronicle about two years ago. Unfortunately it brought back from the States photographs, which I was shown by the Gardeners' Chronicle and I had to give in that so far as they went it was correctly named, but I have held the view you give us, Mr. WALLACE. I still think there is a lot in it, but there is one very definite snag which cannot be explained away. You can self-pollinate 'Maxwill' and you can cross-pollinate between many seedlings of 'Maxwill' but you will always get a lot of chaff in all the seed pods ; I think that is because the plant is a hybrid. I would like to accept Mr. WALLACE's view in its entirety.

Mr. WALLACE : Let it be between *Davidi* and *Willmottiae* ?

Mr. COMBER : I think so.

Mr. WALLACE : *L. Maximowiczii* flowers in August, 'Maxwill' shows no tendency to retard itself and it flowers before *Davidi* ; the bulb factor is a strong point.

Mr. COMBER : 'G. C. Creelman' does produce bulbils under certain conditions. I have some in the nursery at the moment.

Answering Mr. COTTON and one or two other people, I can say quite confidently that accidental pollination by *L. regale* is not the cause of *L. regale* reproducing only *L. regale* when crossed by other Lilies. It has been done too many times by too many careful people.

Mr. RAFFILL : I can endorse that. Some years ago, owing to the fact that everybody was getting *L. regale* seedlings after the pollen had been used from another parent I took the precaution to keep some *L. regale* stored in dry boxes, I potted them up late and they flowered in the late summer. I used all sorts of things on these regales, all of which had been emasculated in the bud stage, so that there was no pollen about from this Lily, and I got only *L. regale*. There was no other pollen used but the male parent, so that I am quite sure *L. regale* is parthenogenetic.

II. SOME QUESTIONS AND ANSWERS.

MAY 10, 1938 : F. C. STERN, F.L.S., in the Chair.

The CHAIRMAN : We are to have a discussion on new lines ; it is what I would like to call the Lily Group's Aunt Sally Party, because as far as I understand you can all have free shots at some of us here ; at any rate we are going to try to answer your questions.

A MEMBER : Is there a white Crown Imperial ? Somebody told me they existed, but Mr. CONSTABLE says they do not.

Mr. ROSENHEIM : There is one. I should say you would get it in Holland, probably from Messrs. VAN TUBERGEN. I have two paintings of the white form.

Mr. CRAIG : I would like to know the reason for deep planting. I have not been able to see why this is so often advocated. There might be several reasons. One, because Lilies are found so in their natural habitat, but against this is the fact that we cannot reproduce those conditions. Two, to afford protection from frost ; this can be had from a mulch. The last is to allow room for stem root production. This again can be provided by mulch. If there is a reason I would like to know it so that I may act accordingly.

Mr. CONSTABLE : I think the main reason is the one put forward, namely the protection and encouragement of stem roots. We do not advocate that all Lilies should be planted deeply ; in fact, the majority of catalogues and books today tell you that the depth of planting is settled by the variety or species of Lily. Most European Lilies which make few or no stem roots are planted less deep than the Asiatic Lilies, but the chief reason—at least that has been my reason—is that it is to protect and encourage stem roots. No doubt you can get over that difficulty by mulching, but as a rule adding to the top soil is a rather more expensive operation than planting the bulb in the first instance at a reasonable depth.

The CHAIRMAN : Would you advocate with young Asiatic Lilies to plant them deeply ?

Mr. CONSTABLE : There again I think we should be guided by the size of the Lily. I should not, for the sake of argument, say that a small bulb should be put at the same depth as a mature bulb until it had reached a certain age or size. That is why I think it might be necessary in most instances to transplant. I do not suppose any of us would plant tiny bulbs straight away into their flowering quarters. If we did, then as far as one could do so, the soil would have to be added to in order to give proper protection and encouragement to the stem roots.

The CHAIRMAN : Do you not think a small Lily seedling, say a year or two old, will pull itself down to the right depth ?

Mr. CONSTABLE : I believe so : it has been suggested that it has contractile roots for that very purpose ; as far as my experience is concerned, I have never attempted it. Perhaps some other member would tell us. Growing Lilies commercially is rather different from growing them in a private garden.

Capt. JENKINSON : I want Mr. HARLEY to tell us the results of planting Nomocharis deep and shallow.

Mr. HARLEY : A number of years ago GEORGE FORREST told me he found Nomocharis bulbs eight to ten inches deep. I planted out some young bulbs raised from seed about eight inches deep, and as they did not appear during the summer I dug them up and planted them three to four inches deep, when they came up and flowered the following

year ; the bulbs were two or three years old when I put them in. I now put them in three or four inches deep.

The CHAIRMAN : Do you find they go down afterwards ?

Mr. HARLEY : I think they do, but I am quite certain those small bulbs planted deeply do not appear without some difficulty. We saved them by lifting them and bringing them up. Next year they were all right. I think it is a mistake to plant these small bulbs too deep. In their natural habitat it may be a different thing.

Lady MARTINEAU : I once planted a bulb of *L. pardalinum* rather deep ; it did not do very well, so I dug it up. We found it had formed stem roots with another bulb three to four inches above the first bulb and it had flowered. The soil was very wet and sour.

Mr. COMBER : At Burnham we plant at two inches less than we advertise in the Catalogue. That sounds very contradictory, I know, but the catalogue is based on the cumulative experience of a wide range of soils, and I am dealing mainly with small bulbs, but it seems to apply to the larger ones also. I plant very few bulbs deeper than four inches, and I am on hot, dry, shallow ground.

The CHAIRMAN : What about stem-rooters ?

Mr. COMBER : It is the same thing.

The CHAIRMAN : When you dig them up do you find they have gone down at all ?

Mr. COMBER : No. We top dress, I will admit that, and we keep the surface hoed freely, but actually the top of the bulb is only 1½ in., or at most 2 in., below the surface. The results speak for themselves.

Mr. E. N. MULLETT : Four inches from the top or the bottom of the bulb ?

The CHAIRMAN : Four inches from the top I should think.

Mr. COMBER : No, usually about 2½ in. to 3 in. for the larger ones. It depends on the size of the bulb when put in. Deep planting may grow better flower stems, but it certainly induces the production of bulblets out of the food which should have gone to the bulb. We are primarily interested in obtaining, without forcing by manures, as large a bulb as possible.

Professor LYTEL : Does it not depend on the soil you have got ? In my own garden I plant *L. auratum* in porous peaty soil eight inches or nine inches deep and they do very well. I tried some *L. auratum* in rather stiff soil, and they did very badly at the same depth. I then planted some more *L. auratum* in the same stiff soil about four inches deep and they did as well as those in the peat about eight inches deep. It depends on your soil, whether it is porous or not. It also depends on your moisture. For instance, at Logan they can put *L. auratum* about three inches below the surface and the soil is so moist that their stem roots can always keep moist and they do magnificently. If I planted *auratum* shallow as they do at Logan, in my peaty soil I know it would starve out. For the sake of the stem roots I also mulch very heavily.

The CHAIRMAN : I think that is very true. I grew *L. pardalinum*

on very hot, limey soil very badly. Mr. CRAIG from Boston, who has a great deal of experience, came round my garden one day and said "You have those pardalinums much too shallowly planted; you should plant them 2 or 2½ feet deep." Liking to try a new experiment I planted them 2 feet deep, and quite a lot of them in the first year just showed, the second year they came up well, and this year, even in this dry weather, they are doing well.

Dr. TINKER : If I might generalize, Lily bulbs do require an adequate supply of both air and moisture; what we have to aim at is a balance between aeration and moisture. If we provide only for aeration, of course we dry the bulbs; if only for moisture, the bulbs may rot. We must aim at this balance according to the size of the bulb. If you take an ordinary bulb and put it in a tumbler of water and turn the tap on, you can keep it there for six months or so, and as long as the water is fresh it will not rot. But if you turn the tap off and leave it in the water you may have a filthy mess in about ten days. If the soil is very dry and the air gets down freely, then we can plant deeply. On the other hand, if we have a soil that tends to "cake" and does not get the air down in it, then we must open the soil up so that we can get air from above, and plant nearer the surface.

Mrs. LINDSAY SMITH : How deep would you plant *L. Parryi*? *L. pardalinum* I suppose is a swamp Lily, and *L. Parryi* I believe is another, at any rate it is a moisture-loving Lily.

Capt. JENKINSON : Two-year-old seedlings of *Parryi* we plant about two inches deep, but the mature bulbs we put down at about four inches, and they anchor themselves a little deeper than that.

Mrs. LINDSAY SMITH : You plant them in a moist part, do you not?

Capt. JENKINSON : Provided the drainage is perfect.

A MEMBER : *L. pardalinum* is a swamp Lily, but we grow it in quite dry soil, in leaf mould and soil.

The CHAIRMAN : I believe in its natural habitat it is found in rather swampy ground, not in swamp, but in hummocky ground, rather above the water, but where its feet can get into the water. Mr. COOTTS is here, perhaps he could tell us how they grow it at Kew with such great vigour.

Mr. COOTTS : There is a fairly widespread misconception about the so-called swamp Lilies; the term is very misleading. As far as I know no Lily will grow under swampy and stagnant conditions. You have answered the question very well, Mr. Chairman. Lilies are always found above the water line; although the roots may be in the water, it is always moving water, on the margin of streams and places of that sort. *L. pardalinum* at Kew is more or less a weed; one would imagine the conditions at Kew were anything but favourable to it; it is very hot and dry, yet it increases so freely that it has to be lifted every third year and divided, else it gets into such a dense mass that you get practically no flowers. No one should have any difficulty in growing *L. pardalinum* if they plant it about four inches deep and give

it plenty of half decayed leaf-mould in a well-drained plot. They get no special attention at Kew, except that they are planted in beds of Rhododendrons.

A MEMBER : Are those beds watered ?

Mr. COUTTS : Yes, but generally for the benefit of the shrubs, though, of course, the Lilies benefit from the watering, especially during dry spells.

A MEMBER : The question of the formation of bulbils is very interesting. Who can say what is the natural habit of the Lilies that form bulbils in increasing ? The bulbil on falling off must lie on the surface, yet it apparently grows and develops into a bulb in time. Does it finally work its way down into the soil ? If you have bulbils off, say *L. myriophyllum superbum* to grow, should they be put practically on the surface to start with to form their growth gradually and develop, or should they be put under a certain depth of soil, because it appears in Nature they must lie on the surface to start with ?

Dr. TINCKER : They may pull themselves down by contractile roots. I advocate transplanting them. I should start them very near the surface, and in one year's time move them if they have grown well.

Professor LYTTEL : It is rather a false argument to say things happen in such a way in Nature and therefore we ought to do the same thing in cultivation. In Nature I suppose ninety-nine per cent. of the bulbils dropped will die. It would be no good our simply scattering bulbils and imagining some will survive by dragging themselves down, you will get very poor results by that method. I do not bother with *L. tigrinum*, it sows itself all over the place, but only comparatively few survive, and they drag themselves down.

The CHAIRMAN : I think it is rather a mistake to copy Nature too closely. Things are different in Nature from what they are in the garden. You can take hints from Nature, but it does not always work out the same in the garden.

Mr. HARLEY : With *L. Sargentiae* a tremendous number of bulbils fall down and the slugs devour them. If the place is forked over you find a great many coming up.

Mr. WHITE : May I ask for instruction with regard to *L. × testaceum*. Should it be planted shallow like *candidum* ? Is lime essential to it ? I have failed dismally with it.

The CHAIRMAN : My own answer to that question would be that *testaceum* wants to be planted shallowly, rather like one does *candidum*. That is my own view. It does not like an acid soil, but whether it requires lime I do not know. I do not think it does; probably it likes a neutral soil, but certainly not an acid one. Mr. SCRASE DICKINS has had some experience with regard to the growing of *testaceum* on rather an acid soil.

Mr. SCRASE-DICKINS : The soil is very acid indeed. I believe all you want to do is to correct the soil with the right amount of lime, not necessarily give it as food, because the plant may not require it, but give the plant the soil it wants.

A MEMBER : May I say about *testaceum* that they grew very well near London in plain, London brick-earth without any fraction of lime, but did not increase very rapidly. A batch of 23 bulbs has been in position about seven or eight years. A bulb that got damaged increased enormously and produced heaps of bulbils from the damaged scales. The others grew and flourished in perfectly normal brick-earth planted about two or three inches below the surface. I do not know whether it is this dry year, but they do seem to suffer from the withering of the lower leaves ; it may not be disease—the bulbs continue to bloom very freely. Is it a question of the cold winds we have had this year—it is in a very exposed position—or is it because the bulb is in the ordinary brick-earth ? The bulbs do not seem to die off, they throw up spikes 5 ft. or more high.

Mr. CORTON : I think the withering of the leaves might be partly due to cold winds, but my own view is that in most cases it is due to a virus disease.

A MEMBER : Speaking of *L. × testaceum*, I find it necessary to pot up my bulbs in the autumn and during the winter, as I have a rather cold, wet soil. They are planted out in the spring, indeed a batch of *L. × testaceum* was planted practically as they came out of the pots. They did remarkably well, growing five to six feet high. I do not know how much one is justified in burying the green stem of the Lily under those circumstances, but it is a subject I am rather anxious to learn about. I have *L. Martagon album* waiting to go out.

The CHAIRMAN : I think most people agree *testaceum* should be planted shallowly. Will somebody answer the question about *L. Martagon* ?

A MEMBER : *L. Martagon* does very well with me in a very heavy clay soil, I always plant them about three to four inches deep. I never plant any of my Lilies deep on account of the heavy soil. I do not think I ever plant any more than six inches, at least very few.

Mr. CONSTABLE : I planted out certain bulbs from pots, practically all species, including some Martagons ; at this time of the year Martagons should be planted with about two inches of their stem below the surface.

Major TREHEARNE : With regard to *L. × testaceum* it is a Lily I can never do very well with. Two years ago in Scotland where I was shooting, I went to a keeper's house and saw about 300 of them in a potato bed ; he did not know what they were, I took several of these bulbs and they grew very successfully. They were in a Scotch heather soil. I dug them up myself and they were a foot deep when I found them. Is it not rather a mistake to plant *L. × testaceum* near the top ?

The CHAIRMAN : I do not think it is.

Professor LYTTEL : One finds by experience that certain Lilies the first year they are planted sometimes do not come up at all, yet we are quite happy because we know they are going to come up the second year. The chief example is *L. Szovitsianum* or *L. monadelphum*,

but I have had rather a different experience with a plant—I do not know what I am allowed to call it, whether it is *Willmottiae unicolor* or *sutchuenense*—I planted a clump and they came up and flowered beautifully the first year. Last year they never appeared at all. So I thought "another good thing gone west," and this year I was going to plant something in the same place, but discovered this beautiful clump of *L. Willmottiae unicolor* or *sutchuenense* is again coming up strong. What has happened to those bulbs during last year? After they had had one good year's growth they remained absolutely and completely dormant. Can anyone explain the physiological reason?

A MEMBER : I have had exactly the same experience with *L. Brownii*. It came up beautifully the first year and last year it did not appear at all, and I was just about to plant something else in the place when I noticed all the spikes coming up.

The CHAIRMAN : Before Mr. COTTON answers, I may say it is very often the case with *L. leucanthum centifolium* that it does not come up the first year, so anybody who has planted it need not be disappointed if it does not appear the first year, because very likely it will come up the second; very often the gardener digs over the place and that is the end of the Lily. I suppose there is no doubt this would apply to a number of bulbs.

A MEMBER : I planted *L. leucanthum centifolium* and it did not appear; I was going to throw it away until I found the bulb was quite healthy.

Professor LYTTLE : The Chairman's point about *L. leucanthum centifolium* is that they do not always come up the first year. That happens with a good many Lilies. My point is that Lilies came up the first year perfectly, bloomed vigorously, and then took a year's rest. I want to know why and how and what happened?

Mr. COTTON : I cannot answer this question. I have heard of the same experience with *L. Hansonii*; the plants did well and then missed one year. As to the name of the red Lily, it is not *L. sutchuenense*.

A MEMBER : Might I suggest the original bulb does not like being disturbed and it missed the next one or two years and its smaller bulbs come up, the offsets; the original bulb goes.

The CHAIRMAN : Perhaps Dr. TINCKER would take that into account.

Dr. TINCKER : I hoped to evade this question as I am unable to answer adequately. There are several factors that may influence or induce dormancy; we are only beginning to understand some of them. Regulatory substances are produced in the plant that inhibit buds. How these are formed we do not exactly know. Dormancy of other parts of the plant may be caused by other means—for example, the winter rest of Lilies due partly to temperature conditions, and the induced dormancy of seeds due to adjusted concentrations of oxygen and carbon dioxide in air. Dormancy may be broken or terminated by various means; in some cases buds may develop after only rubbing

the stems with a pencil ; dormancy may be broken by subjecting tissues to small amounts of various chemicals and gases. Dormancy can occur at various stages of the plant, and it seems that the Lily bulb may be dormant when young and small or when old and large, but the mechanism of this dormancy—a fascinating subject—has not yet been worked out, so I am incapable of answering the question adequately.

The CHAIRMAN : Is it possible they do not make their roots in one year ? I have found with bulbs that have not come up that the root action was very poor.

Dr. TINCKER : I think it is doubtful in the first year, but Professor LYTTEL'S case was in the second year.

Professor LYTTEL : That is my puzzle, that they did not come for the second year after being very good the first year.

The CHAIRMAN : I want to ask Mr. CONSTABLE whether *L. Willmottiae unicolor* is the same as what used to be known, and may still be known, as *L. sutchuenense* ?

Mr. CONSTABLE : That is the exact plant, the plant that used to be shown under the name of *L. sutchuenense* and which we now look upon as *L. Willmottiae unicolor* ; that was the plant shown for many years under the name of *sutchuenense*.

The CHAIRMAN : *L. sutchuenense* as I remember it—I think Mr. VAN TUBERGEN first had it—was not half such a strong plant as the plant I saw in your stand last year which was a magnificent one ; it did not appear to be the same thing.

Mr. CONSTABLE : I think the plant you have in mind was a definite cross—*L. Willmottiae* × *L. Willmottiae unicolor*. The plant you have in mind was a much finer thing than *L. Willmottiae*, and far finer than what we used to know as *L. sutchuenense*.

The CHAIRMAN : What did you call it ?

Mr. CONSTABLE : We have not given it a definite name yet.

Mr. MARK FENWICK : I should like to know what my Lily is, we will call it *Willmottiae* if you like, it is a very fine robust form. I think there were about 5,000 blooms and buds out at the same time in my garden last year. I bought it as *L. sutchuenense*, you might call it *L. Willmottiae*.

Mr. CONSTABLE : The true *L. Willmottiae unicolor* as I know it does not grow as tall as *L. Willmottiae*. It is naturally much more dwarf in habit.

Col. NAPIER : I thought the unspotted *L. Willmottiae* was supposed to be *L. Willmottiae unicolor*.

Mr. CONSTABLE : It is supposed to be, but unfortunately you will find certain flowers come with thin spots, the majority are without spots. I do not think you can take it as absolutely definite that it is entirely without spots.

Mr. COTTON : I would like to say a word or two about this unspotted Lily. I happened to examine only yesterday the original dried specimens of *L. sutchuenense* from Paris, as they have been sent to me

on loan. They were described by FRANCHET in 1892. There are five specimens and they are all heavily spotted. It is therefore quite certain that the unspotted Lily now in cultivation in this country is not FRANCHET'S *L. sutchuenense*.

Mr. MARK FENWICK. What is it?

Mr. COTTON : I think it may safely be called *L. Davidi* var. *unicolor*. I have written a paper on the subject to be published this autumn in the Lily Year-Book. It has been called *L. Willmottiae* var. *unicolor*, but *L. Davidi* var. *unicolor*, would be more correct (p. 35).

The CHAIRMAN : There is one point about *L. Willmottiae* which is very interesting and which does not come into the purview of the botanist, but which does come into the purview of the gardener. For example, take *L. Davidi* and *L. Willmottiae*. I want to know if other people's experience is the same as my own. I can always tell *L. Willmottiae* when it is a few inches high, because the stem always comes up sideways, and also this hybrid of Mr. CONSTABLE'S *L. Willmottiae* × *L. Willmottiae unicolor*, or whatever it is; that also always comes up sideways. *L. Davidi* never comes up sideways, it always comes up straight. A gardener notices these things, and perhaps a botanist would not have the opportunity of seeing them.

Mr. COMBER : I quite agree. The stem comes upright in 'Maxwill' also, not sideways.

A MEMBER : I have grown *L. sutchuenense* from one bulb dividing it up and this year we have five or six, a shoot has come straight out from underneath, the other three or four have come up just as every other time straight up. They are all from the same bulb.

The CHAIRMAN : You often find that Lilies in pots come up and go down again and come on one side of the pot, perhaps Mr. COMBER will tell us why.

Mr. COMBER : I think there is a very good reason for it. Lily stems come up slightly, run along underneath and come up straight again either in the pot or in the open. It occurs most often among young bulbs, and I think the reason is that the young bulbs are usually formed on the old stem immediately above the parent bulb. They have to get away from the impoverished area of soil and the stems go up near to the top of the soil and may run along underneath for as much as two feet. In the following Autumn when the food manufactured by the leafy parts goes down most of it comes to rest in the bulblet at the base of the upright stem and is not carried right back to the original small bulb; in effect it means that the young bulb is transferred from one place to another, about two feet away, which gives the young plant fresh soil to grow in.

Capt. JENKINSON : Could you tell me if you have observed whether the leafy margin of your sideways-growing Lily which you call *L. Willmottiae* is flat or definitely decurved?

The CHAIRMAN : I am afraid I have never noticed.

Mr. COTTON : Is it not flat?

Capt. JENKINSON : In *L. Willmottiae*, yes.

Mr. COTTON : Does *L. Davidi* always come up straight from the bulbs ? We have some plants of *L. Davidi* which have "run" and come up obliquely.

The CHAIRMAN : Mr. CONSTABLE and Mr. COMBER have had far greater experience than I have.

Mr. COMBER : In *Davidi* the stem always comes up through the ground erect unless the bulb has been planted obliquely ; when it runs, as it sometimes does, it still comes up erect out of the ground.

Mr. HARLEY : *L. Davidi* always comes up from the same place, *L. Willmottiae* comes up about a foot away ; they will come up through the grass after running under. *L. Davidi* always comes up straight, sometimes the roots come up two inches and then go down again.

The CHAIRMAN : I think it is quite a character.

Professor LYTTEL : Arising out of this, did Mr. CONSTABLE import last year from Mr. WADA a Lily he listed as Species Nova. I took a kind of "pot-luck" chance and ordered a dozen. I planted them, but had no idea what they were. They have come up exactly like *L. Davidi*, not like *L. Willmottiae* or like *unicolor*, and yet they have the flower of *L. Willmottiae*. What Lily is it ? Is it the hybrid Mr. CONSTABLE mentioned ? Did he import any of this Species Nova ?

Mr. CONSTABLE : No.

The CHAIRMAN : Had it a glabrous or hairy stem ?

Professor LYTTEL : It has a slightly hairy stem. It is coming up well this year, very strongly in the same place, not sideways like *L. Willmottiae*.

Mr. COTTON : It is not a form of *L. Maximowiczii* ?

Professor LYTTEL : It is like that, but very much stronger.

The CHAIRMAN : I had a Lily in flower last year from WADA, quite the finest form of *L. Maximowiczii* I have ever seen.

Professor LYTTEL : It is probably the same thing.

Mr. CONSTABLE : I did have the plant from WADA, but not under that name, and it flowered as you describe, and is undoubtedly a form of *L. Maximowiczii*.

Mr. CRAGG : I only started growing Lilies last year, and as I want to have 4-5,000 naturally I do not want any to die on me. I have a lot of small bulbs of *L. pumilum*, *L. rubellum* and *L. pomponium* and want to know the best way to treat them. Some are supposed to be short-lived. Is this so or is it the grower's fault ? As a novice I am quite at sea.

The CHAIRMAN : Are they seedlings in boxes ?

Mr. CRAGG : No, in open beds. I am told when they come to flower the mother bulb has gone.

The CHAIRMAN : I think *L. pumilum* is a very short-lived Lily. We will ask the different experts. But the others are not short-lived. *L. rubellum* has been going at Wisley for thirty years, and certainly it has been going in my "billiard table" for some four years. It is coming up well this year. The other one, *L. pomponium* is a long-lived Lily.

Mr. CRAGG : Would it not be possible to treat *L. pumilum* as a herbaceous plant, keep on shifting them, and keep them going that way ? I wondered whether I could not dig them up as soon as they have finished flowering, and enrich the soil for the plant ?

The CHAIRMAN : Can anybody answer that ?

Mr. COMBER : I have one small contribution to make on that. *L. concolor* and *L. pumilum* have the reputation of being short-lived. Last year I found a *L. pumilum* in a Cambridge garden about three feet high, and was assured it had been there five years ; it was particularly strong and robust and it looked like going on for another five years. I think the only method with these Lilies is not to seed them too heavily, but feed them well. Probably transplanting them would have the effect of keeping them going quite well.

The CHAIRMAN : I think *L. pumilum* wants a good feeding soil, but *L. pomponium* wants a very hot place. After all, it is found in the South of France under very hot conditions ; with me it grows on the face of the chalk where it gets very hot conditions ; it has been there for a good many years.

We have had some letters from members of this Group who live in different places overseas. I thought I might just read one from Col. DWYER of Kilmacud House, Co. Dublin, as it contains a very interesting suggestion, and perhaps Dr. TINCKER or Mr. COTTON will be able to answer.

" During the discussion last year on the production of Lily bulbs from scales, the question of the influence of nicking the scale cropped up.

" I enclose for favour of inspection two representative specimens of a series of scales of *L. Martagon* inserted some five weeks ago, one nicked and the other untouched—the nicked scale bears a bulblet for every nick, the other a small number of somewhat larger bulblets. I have had comparable results in the other species. Unless in special cases I do not nick the scale, as a smaller number of larger and more vigorous bulblets appear preferable. This, however, brings out a point of extreme practical importance, which is that if, under favourable cultural conditions, a healthy scale will not (as often happens) produce a bulblet, nicking, or other treatment of the scale has usually no effect. Frequently one finds a proportion of scales in a batch which, though remaining sound, are unproductive : also the transverse division of a scale rarely results in the segments nearer the apex of the scale producing bulblets. Long puzzled by this, I arrived at an explanation, founded, however, exclusively on observation and experience, and one which I have not heretofore heard or seen described. This is that the genetic tissues in the scale already exist before the scale is separated from the bulb, that these tissues are strictly limited in area and distribution, and that a portion of a scale which is separated from the scale's genetic area cannot possibly be made to produce a bulblet. In the majority of species and hybrids the genetic tissues appear to be aggregated at and near the base of the scale ; in some, however, e.g., *L. ×*

testaceum, the area frequently extends from the base around the sides of the scale, while in jointed scales, these tissues sometimes occur at the joint as well as at the base. Further, these bulblet-producing tissues appear to exist as islands ; they are not, that is, continuous, even at the base of the scale ; and to stir them into activity they require some damage or exposure such as is caused by breaking the scale away from the bulb, or by nicking the scale. If correct this would explain many observed facts, e.g., why one scale produces one bulblet and another, apparently identical, produces six ; this simply means that the tear at the base of the scale has exposed in one case a single island of specific tissue, in the other six.

"Working on this theory I have in my own experimental work here greatly increased the certainty with which I can produce bulblets from scales, by ensuring that the scales are detached as *close as possible* to the axis of the bulb. If care is taken to ensure this practically all healthy scales will be found fertile ; even the outer scales from one year old bulblets. Working on the same principle I have had good results from the only *Nomocharis* I have tried (*N. pardanthina*)."

That is a rather interesting idea. What I understand is if you take the scale off and you get some part of the bulb on the base of the scale—as you will see when this is passed round—the bulblets are formed on the part which is attached to the bulb. There is only one bulblet on the one attached to the bulb. Perhaps Dr. TINCKER can tell us if there is anything in that.

Dr. TINCKER : I do not think there is any special part of the scale that is a bulb-forming part—that there is any special tissue. If you take an ordinary scale and cut it in two straight across, bulblets may form at the base under standard conditions.

The CHAIRMAN : Not on the top ?

Dr. TINCKER : No.

The CHAIRMAN : Does that not rather bear out what he says ?

Dr. TINCKER : Yes, it does.

The CHAIRMAN : It is part of the old bulb and not separate, they come more easily from that part which is attached to the bulb than from the part which is not attached to the bulb. That rather bears out what he says—if you cut it in half, you will not get bulblets on the top half.

Dr. TINCKER : They always develop towards the bottom, even if you put the scale in upside down. In most cases the bulblets form at the base of the scale. There is a tendency to get bulblets at the base if you divide the scale in two. Bulblets form at the side occasionally.

The CHAIRMAN : I was told once by a well known grower that if you nick the scales you get more bulblets.

Dr. TINCKER : I do not think nicking the scale produces any more plants in one year. It is my experience that there is not much material gain from nicking, as the more numerous bulblets are smaller.

Capt. JENKINSON : In those two scales passed round there is one with all the bulblets at the base carefully nicked.

The CHAIRMAN : This is our first experience of an Aunt Sally party. I hope you think it has been a success and the more questions you give us the better we shall be pleased. If you agree, perhaps we might have another Aunt Sally party next year.

III. LILIES FOR EVERY GARDEN.

At the Lily Group Dinner July 5, 1938.

Chairman : Mr. F. C. STERN, F.L.S.

The CHAIRMAN : It is our custom at these dinners each year to have a discussion, and to-night it is to be on "Lilies for Every Garden" which I hope everybody will join in. It is being opened by the Rev. Professor LYTTEL, who has very decided views, as we all know, on this subject, and I hope Mr. WALLACE, with his great experience, will also join in ; we are very pleased to see Mr. WALLACE here to-night after his illness looking so well. Then we have another good friend, Mr. CRAIG, who has arrived straight from Boston, U.S.A., to-night to come to this dinner. I hope he will tell us what he thinks with his great experience would be the best Lilies for every garden.

Then we have Lily-growers from every part of the British Isles here to-night—Lady ALICE SHAW-STEWART from the West of Scotland, Mrs. TENNANT from the East of Scotland, and Mrs. LEES from Wales ; I hope they will tell us how their Lilies grow in their parts of the country.

One of the things we are trying to do through the Lily Year-Book is to find out what Lilies do best in the different parts of the country, and a questionnaire has been sent to you.

I should like to tell Mr. Rose how delighted we are to see his Lilies looking so beautiful in this difficult year.

Before I sit down I want to give you a toast—it is not on the programme. It is a toast because to-day, or rather this week, is one of the most celebrated weeks in the Lily Calendar. To-day is the centenary of the first flowering of the oldest Lily hybrid that we have, *L. × testaceum*. *L. × testaceum* flowered first in a German nursery in 1838. The German nurseryman received a box of bulbs from a Dutch nurseryman in 1836 and they were supposed to have come from Japan. He planted them and they flowered, and among them was *L. × testaceum*. He propagated it by scales and sent some of the Lilies to a nurseryman at Tooting, Messrs. ROLLISON. They flowered that Lily and in 1842 it was noted in the Botanical Register and in 1843 illustrated by LINDLEY and named by him. He said it came from Japan.

Professor LYTTEL : I suppose it is shocking of me to begin with telling a story, but this old story does rather lead on to the subject on

which I am to begin a discussion. It is about a Scots minister who was very serious and conscientious and who thought that his flock needed more direct instruction in the Bible. He therefore announced that on some Sundays he would replace the sermon with a reading from the Bible, which he would explain verse by verse. Unfortunately he began with a rather difficult chapter from one of St. Paul's Epistles. He read three verses and explained them, but when he had read the fourth verse he suddenly realized that he himself did not know what it meant. He read it a second time and said "My friends this is a difficulty." He read it a third time and said "My friends this is a great difficulty." He read it a fourth time and still did not know what it meant, so he said "My friends this is a very great difficulty. Let us boldly face this difficulty, and —— pass on!" Perhaps that is why we clergymen are called "Parsons."

I tell this story because I find that I have taken on a subject which is very difficult and it would be better for me and for you if I were to imitate the Scots minister and "pass on." The subject announced for discussion is "Lilies for Every Garden," and that does not sound very difficult; but Mr. SIMMONDS, in forwarding to me a request to open the discussion, made it much more difficult. He asked me to choose six Lilies only, and I forget if he said which *might* be or which *should* be grown in every garden. The former is less difficult, for it would simply mean choosing six Lilies easy to grow. But I take on the more difficult of the suggestions because we want an animated discussion and the best way to secure that is for the opening speaker to be thoroughly provocative. I do not expect any one will agree with my choice, and I expect lots of bricks will be thrown at me for including certain Lilies in my six and excluding others.

The choice of six Lilies which should be grown in every garden is very difficult, for it depends on so many variable factors. There is first the very variable factor of climate and soil. Lilies I would choose for my peaty soil would not be chosen by our Chairman with his limey soil. Lilies which I would choose for a warm garden on the South Coast would probably be rejected by any one who lives in the cold North. There is also the factor of the varying degree of skill in gardeners. Some Lilies could be recommended only to experienced experts. We cannot all grow *L. leucanthum centifolium* like our Chairman, *L. Bolanderi* like Mr. ROSE, or *L. Parryi* like MRS. SPENDER-CLAY. But on this point luck may come in. Gardening is a very inexact science and Nature is always playing tricks on us which defy our analysis. And especially tricks are always being played with such fickle folk as Lilies. A difficult Lily may fail with an expert and succeed with a beginner. Another may succeed in one part of a garden and fail in an apparently similar part of the same garden. I am lucky enough to be able to grow *L. philadelphicum*, but apparently most gardens are not so fortunate. I don't know why.

Finally the choice of six Lilies depends on the inevitably variable factor of personal opinion on the comparative beauty of certain Lilies,

and here I am going to be thoroughly provocative and I shall expect lots of bricks to be thrown at me. I grow nearly all species of Lily, and all have their beauty and their use. But I classify them according to whether they appeal to me mainly as ornaments in a garden or whether they have also extreme beauty of individual bloom. Let me be bold enough to invite criticism by saying that in the lower class I put nearly all Lilies with upright blooms such as *L. bulbiferum croceum* and *L. × elegans*. These are very ornamental in my garden, but I admire them at a respectful—or disrespectful—distance. I do not admire either with the close adoration I give to such Lilies as *L. Brownii* and *L. japonicum*.

Some other Lilies I also put in the second class. I shall expect at least one brick to be thrown at me when I say that I do not care for *L. Hansonii*. It grows very well with me and makes a fine show, but at close quarters I think its texture is coarse and its colour crude. At Ford Manor it was flowering near *L. Parryi* and it looked like a cart horse near a thoroughbred! Again *L. Henryi* does not appeal to me a bit. It is a glorious grower and is one of the easiest of all Lilies except in pure peat. But where these huge stems produce squinny flowers of an undistinguished colour and of a size and shape like a poor *L. speciosum* I look on it as simply inadequate. I grow it, but I plant it behind shrubs, so that I need not stake it, but also so that I cannot get too close to it!

So now you see how difficult it is for me to suggest six Lilies which should be grown in every garden. They must not be too difficult in the average garden, and they must be individually beautiful to me. I really ought to "pass on," but I must not shirk my task, and I will boldly select six.

First and foremost I put *L. regale*, and I at once hear murmurs of dissent. You will all agree that it is a most beautiful Lily, that it is very easy to grow in almost any soil or aspect, and that it is very easy to reproduce and very cheap to buy. But this year has emphasized its weak spot, its liability to be cut by a late frost. I cannot deny this, but I think over-emphasis has been placed on the experiences of an exceptional spring, and the balance of advantages is overwhelmingly on the side of the good qualities of *L. regale*. Let me give you my own experience with this Lily. I have grown it since it was first introduced, and this year for the first time I have lost some blooms through frost. But even then I only lost some thirty spikes out of nearly 400, and the beauty of the survivors more than recompensed me for the losses. I made a careful examination of the clumps which were frosted, and in nearly every case I found that they were clumps exposed to the morning sun. This seems to illustrate a point in gardening, which one learns from experience, but for which I personally can give no scientific explanation. Just as a frozen foot in a human being has more chance of recovery if slowly thawed out in snow or in cold water so a frosted shrub or Lily should be protected from the rapid thawing by hot sun. The moral therefore, seems to be that

L. regale should be planted in semi-shade, or at least not facing East. But here again the inexactness of gardening comes in and I have seen in some gardens *L. regale* untouched in full sun even this Spring.

My second choice is *L. Szovitsianum*. I am not very certain as to the right names for the various forms of this Lily. There is an early flowering form with strongly reflexed petals which I know as *L. monadelphum*. *L. Szovitsianum* is the name applying to a later flowering form, of rather lighter colour and with less reflexed petals. An intermediate form I know as *L. colchicum*. *L. Szovitsianum* is to me the best. It is a most beautiful Lily and a good grower in almost any soil or aspect. It has the disadvantage of taking a year to establish, but this disadvantage it shares with most Lilies. Very few Lilies share with *L. regale* the happy quality of flowering really well the first year after planting.

My third Lily must be one of the forms of *L. Martagon*. Although I admire tremendously the beautiful hybrids produced by Mr. ROSE, yet my first choice of this group must go to *L. Martagon album*. But it is very necessary to select a good form. I have grown and have seen many forms with little squinny flowers which are quite inadequate. As to its habits it is a very happy-tempered plant and will succeed in any well-drained soil. It needs early planting and here let me give you a personal experience. My first coloured hybrid of *L. Martagon* came many years ago from Mr. BOWLES. He, as you know, is a very generous gardener, and I always come back from a visit with a basket full of plants. He insisted on my taking this Lily, although it was in full flower, and it established itself at once and flowered beautifully the first year. I wonder if we should not treat some Lilies as we treat Snowdrops and transplant them in full growth.

My fourth Lily must be one of the large group of Martagon-shaped Lilies with red blooms. Such are *L. tigrinum*, *L. Willmottiae*, *L. Davidi*, *L. Maximowiczii*, and a host of hybrids and reputed hybrids. For beauty, ease of culture and vigour I put first *L. × Maxwill*—whatever its origin. It is, of course, not so cheap as *L. tigrinum*, but it is a much finer Lily. It will grow almost anywhere and will make a good show the first year after planting. Where really happy it will tower up to 7 feet or more.

I almost apologize to *L. canadense* for putting it fifth, for though I admire white trumpet Lilies more than any, yet of the other Lilies *L. canadense* stands very high in my estimation. Especially I admire its habit and poise. A well-flowered clump with its charming flowers hanging like Japanese temple-bells is one of the most graceful things to be seen in a garden. It is also quite easy to grow, though it takes a year to establish. It is supposed to demand much moisture, but with me it flourishes in quite ordinary soil so long as it does not get too dry in summer. It has also the good quality of lasting long in bloom, longer indeed than any Lily except *L. auratum*.

So far I have found my task comparatively easy, but I am now feeling perfectly miserable, for I have only one place left and there are

many Lilies which it hurts me to exclude. *L. Brownii*, for example, has an aristocratic beauty which makes it stand almost first with me for beauty. It grows magnificently at Townhill Park and quite well with me, but from observations in some gardens it is, I think, rather temperamental and must be excluded. *L. japonicum* rivals if it does not surpass *L. Brownii*, but here again is a Lily which is distinctly temperamental. It grows very well with me, but some gardeners do not find it easy to establish. Let me give you my experience with this Lily. The problem with all or most Lilies is to combine perfect drainage with adequate moisture in summer. And the time of danger with nearly all Lilies is the first winter after planting before they are established. *L. japonicum* resents winter wet, and especially when newly planted. With this Lily particularly it pays to pot your new bulbs and keep them in a frame till Spring. Old clumps should be covered with a mound of dry sorbex to keep off super-abundant moisture. *L. Sargentiae* also has in my eyes a classic beauty, but apparently few gardeners grow it really well, and to my sorrow I am one of the majority.

What then, is to be my sixth Lily? Lots of bricks will be thrown at me when I choose *L. auratum*, for many do not like it and more cannot apparently succeed in permanently establishing it. But it is so gorgeous, and so distinct, that I must include it. No other Lily with the possible exception of *L. giganteum*—makes such a display in the garden, and no other Lily lasts as long in flower. It has been established in my garden for eight years, and yearly reaches 8 or 9 feet high. As to methods of cultivation my own experience tells me two things. First, this Lily must have deep moist acid or neutral soil with the surface shaded from hot sun. Second—if you want to establish *L. auratum* you must have patience. If you buy big bulbs you will get good spikes the first year by the stem roots, but the second year many or most will disappear. Start therefore with small firm bulbs, be content with small results the first year, and you may hope to establish it.

Well, ladies and gentlemen, here are my chosen six. I know you will not agree with my choice, and I hope you will not, for then we shall have a really animated discussion. I am quite fond of throwing bricks at other people, and I shall enjoy having bricks thrown at me. If there are plenty of bricks forthcoming I shall be justified in really tackling my difficult task rather than copying the example of the Scots minister.

Mr. WALLACE: First I would thank you very much for your kind reference to myself.

But now I have a most difficult task. After listening to a speech with such a wealth of reason behind it, such a knowledge of the subject on which he talked, it is most difficult for the ordinary layman to answer. But you know the subject was the best Lilies for every garden. I could not help thinking that all the while at the back of his mind when he was choosing this particular six and discarding the others

out into the wilderness, the Professor had his own lovely garden where all these Lilies thrive and do so beautifully. They don't do that with me. I am just an ordinary gardener. I am with him entirely with *L. regale* and *L. Szovitsianum*. *L. Szovitsianum* is priceless, a heritage from the East of pre-war years, and I am with him with *L. Martagon album* and 'Maxwill' and *L. canadense*. And of course, *L. auratum* is the first and the last for beauty and growth when it does well; but Lilies for every garden! . . . I am thinking to myself of all the little gardens up and down the countryside. We would like to see the Lilies in them. Professor LYTEL rules out *L. bulbiferum croceum* and *elegans*. You will see them in many a cottage garden. Their colour may be strong—but it is typical of the hot sunny days of summer. There they thrive and their cost is reasonable. They are Lilies for *every* garden.

After listening to the Professor for twenty minutes, for the life of me I don't know what sort of a brick to get up and throw at him except that I do think his whole address has been fashioned on the beauties that are within his own garden hedge, and he sees no reason why they should not exist in all gardens.

Then, in addition to his own experience, he calls in Mr. ROSE as a witness and goes on his way triumphantly and happy, believing all is well. But is that a fair comparison? Has every garden the superb plants you find in that garden, the natural setting, grand cultivation, and glorious effects? It is too trying altogether. No, I do think the Professor should bring his mind down to the small man and the poor man. I grant you that with *L. regale* we may hope to see them everywhere. Then again *L. tigrinum*, the form is right; it is a fine good growing Lily. He castigated *L. Henryi*, but it is nice when it does not get so tall, five or six feet, and the flowers first unfold with their lovely clear colour and green centre. Cut a few spikes and place them on the table. They are things of beauty and they have their purpose in the Lily life. Again when you come to constitution it has a marvellous constitution. We can't get on without our *Henryis*, *Tigrinums*, *Croceums* and *Umbellatums*.

One little Lily he did not mention, *L. rubellum*. If you want to plant a Lily that is going to thrive, of that delightful colour, always use *rubellum* rather than *japonicum*. Again you see we are at a disadvantage; these are things he grows like mustard and cress. It is not fair to us.

Then again he mentions casually *L. philadelphicum*. He hoists himself on to a pedestal. "Come and see my philadelphicums. They are about two feet high." His whole outlook is tinged with his success!

In conclusion I just want to thank him most heartily for his delightful discourse. As far as the six Lilies he has chosen go, if we can see them in gardens doing as they do with him we should all be very very thankful.

Mr. CRAIG: I am somewhat at a disadvantage coming from a

strange land to this meeting, as our climate is so different from yours. We have had a fine growing season. You have not. We have had excellent rains. We had a severe heat wave the week I left, and maxima were 88° to 95° daily. No minimum temperatures were lower than 65°—rather different conditions from yours.

I agree with the reverend gentleman on my left in some of his suggestions. I disagree entirely with others. In our country we have not got people who are so well posted on growing plants as you have here. We have to recommend quite easy subjects. Some of them may love violent colours; to some anything red is like holding up a red flag to a bull. But in your milder and duller climates reds are appreciated more.

For a beginner on our side I would recommend these: we want easy types to give you flowers the first year. We recommend *L. tenuifolium*, an early bloomer, and a good variety of *L. × elegans*. For an upright one, *L. Hansonii*, and after that the immaculate *L. candidum*. Following that *L. regale*, then the robust *L. Henryi*, and then a good form of *L. speciosum*. Last of all the late variety of *L. formosanum*. The early variety we rather despise, but the late *L. formosanum* is a grand thing as we grow it on our side. The florists sow the seed about Christmas at a temperature of 60°, pot them off into 2½ in. pots, plant indoors like Carnations, and then they commence to flower in July, lasting until late October, magnificent flowers, far ahead of any Regals you ever saw. I have seen them in bloom outdoors 12 feet high with 35 flowers on them. We simply call them early or late *L. formosanum*.

Then for the Lilies we personally like, I have to put two Martagon Lilies—*L. Grayi*, which was coming into flower when I left home: it is a lovely thing; and *L. canadense*. *L. canadense* is an easy subject to grow. You can grow it in full sun or fairly heavy shade. It doesn't much matter. All our Lilies when planted are well bedded in sharp sand. The first essential of Lily cultivation on our side is perfect drainage.

Another of my favourite Lilies is *L. × testaceum*. I don't know why the leader of this discussion could omit it from his favourite six. It is my choice of the whole family for sheer beauty. I have seen ladies worship it, but I have never seen them worship *L. auratum*.

Another Lily is *L. japonicum*. It does quite well with me. I don't put *L. regale* in that class because when you have a good spike of 15 to 18 flowers they are much too crowded. I remember Mr. J. C. WILLIAMS said he liked *L. Sargentiae*, as it carried its flowers more separated.

The late *L. formosanum* with us I would have to include in that list. If you could see it as we have it you also would include it in a list of the most beautiful Lilies.

It is interesting to note that many of the best Lilies seen here to-day are hybrids which were produced in the coldest part of North America, viz., Vermont, Ottawa and Manitoba. They have sent

to you many of the best hybrids you have, all the best Regale hybrids, Princeps, Shelburne Hybrid, Pride of Charlotte and G. C. Creelman. I had Mr. SKINNER from Manitoba in to see me before I left. In Manitoba they grow some varieties marvellously, but they cannot grow *L. × testaceum* or *candidum*, but he has raised a number of very fine hybrids.

I have heard 'Maxwill' praised very much, but we like *Davmottiae* even better. Think also of *Cromottiae*, *Scottiae* and others.

Your gardens would be poorer without the number of good hybrids we have sent you from North America. We do have difficulties of weather to contend with, but taken all in all we know that most of the Lilies which have been mentioned here to-night will grow in full sunshine much better than those grown in partial shade. The great bugbear to-day is disease. We are trying now to have a Lily Society in America to assist in discovering means of combating this and increasing the popularity of Lily cultivation. We as growers are all very far apart, but we have been trying to get an International Lily Conference in New York in July next, but don't come in July with the expectation of being comfortable at that time of year. It would probably be 95° in the shade and 75° or 80° at night, and Lilies don't stand up under such conditions. I was amazed to see what fine Lilies you had to-day with the conditions you have contended with of late. We could not make such a display in America, but we can grow some very well indeed. Many are raised from seed. Lily cultivation is advancing by leaps and bounds, and not a few are busy hybridizing.

Mrs. TENNANT of INNES: I think Major STERN has only made one mistake this evening, and that is in asking me to speak, because compared with everyone else here I am a complete amateur in Lily growing, and when Mr. WALLACE gets up and says he is a layman I really don't know what I call myself!

I had for the first time two weeks ago the pleasure of meeting Professor LYTEL at Major STERN's, and we then argued for about two hours on the subject of what he has been talking about to-night—Lilies for the average garden—and after we had been talking for about an hour I said, "I am going to throw one brick at you now." The one brick that I am going to throw is in his saying that *L. regale* is a good Lily. Possibly I am speaking much more from personal experience, because *L. regale* I find is a bad Lily with me. This year it got very badly hit, despite the fact that I did not commit the folly of planting it in the open. Most of our Regales are in a border of common Azalea, and they have all gone down like ninepins with the one exception of about twelve bulbs which were growing in the garden before I went to live there. I think it was this week that I read an article by Mr. GROVE, in which he says that this Lily has degenerated, and I personally agree with him. Whereas twenty years ago *L. regale* was hardly ever touched by late frost I don't think we can say the same thing to-day. The theory he puts forward is that

many bulbs have been imported from foreign sources and the good seed mixed with the bad, and this is the result we are getting.

I will try to tell you something about what we can grow in Scotland. Lady ALICE SHAW-STEWART lives on the West Coast, and I in the North-East; in May we are very conscious of the fact that we face the North Pole. All the same we can grow some Lilies fairly well. It may be because our soil is light and sandy, and such Lilies as *L. Washingtonianum*, *L. Wardii*, *L. japonicum*, *L. rubellum* and *L. nobilissimum* do well. The last at the moment is very fine in pots in a cold greenhouse, but when it is put out it is inclined to get disease. Perhaps it is the North Pole winds.

Another Lily which does very well is *L. japonicum*, and it is much better planted in full sun than in shade, but I live six hundred miles north of London and the sun is far less hot than here, and that may perhaps be the reason. It may also be the reason that I find the colours are stronger with us. Whether that is because during the summer we hardly get any night at all—in fact, at my home on June 21 at the local Golf Club they start a round before midnight and come in at 2 o'clock—I don't know.

There was only just one other Lily that I disagree with, and that was one Mr. WALLACE mentioned for Lily growers in the North of Scotland, and that is *L. Henryi*. We grow some of these planted amongst various rose species. This Lily grows up through the roses and then decides to go to bed lying across the top of the bushes. To me there is no beauty in a Lily that does that, but as we have no lime at all and very sandy soil that may be the cause.

L. leucanthum centifolium we have, and I committed the stupidity of putting it out too soon, so I have not had much chance of admiring it.

L. Duchartrei is good, but it is one of the Lilies that resents being cut. If you cut it the stems are weak next year.

L. Wardii does extremely well and never gets disease, and the same can be said for *L. japonicum*. We pot it up when received, and plant it out in March and trust to luck in April. This year the cold at that time was very unkind. We got snow in the middle of May and that did for four hundred *L. regale*. The only other Lily that it really damaged was *L. Martagon dalmaticum*, which went blind.

Dr. AMSLER: Although the opener of this discussion is a Clerk in Holy Orders you must not take all that he tells you as gospel! In the first place, Professor LYTTLE is an extremely clever man, not only as a gardener, but in other ways; also he and Mr. ROSE live close to Southampton. That is rather a nice climate, and is really far south. As a rule they are much better off than most of us, and are very close to the Isle of Wight, and that is a garden!

I completely agree with what Mr. LYTTLE says about a certain class of Lilies, *croceum*, *umbellatum* and *Henryi*. I think they are most unattractive. I did plant *bulbiferum croceum* last year—which did very well, but I regret its introduction.

His garden is not everybody's garden. I don't think our Chairman would consider *L. canadense* in a list of six. If you are choosing six Lilies which will grow in either lime or lime-free soil, you should not include *L. canadense*. If you do, why not *L. superbum*?

- It is a most lovely Lily, the red form especially; it is about seven feet high and very strong, and has lovely dark green foliage. The scent also ought to be considered in choosing six Lilies.

L. Brownii I think ought to be included, because it is easy. *L. Szovitsianum* is a lovely Lily, very early and well scented and a nice shape, but I don't think it is everybody's Lily. I find it rather difficult. I know that they require time and very often sulk for a whole year.

L. japonicum I find easy, again with the proviso that one does not put them out straight away. If you care to flower them in pots and have them in the drawing room the first year and don't let them go to seed, cut off the dead heads and plant them straight out in your garden, I find they do very well in full sun.

L. auratum has been mentioned, and I think it should be included if your garden is lime-free.

Nobody has mentioned *L. myriophyllum superbum* because I suppose it is not a very easy one, but it will grow in lime-free or lime soil. If you live in the South you should include it. It is a lovely Lily, and I think it takes a lot of beating.

I am not sure but that in *L. tigrinum* you should not go for *splendens* and not *Fortunei*. I prefer the flower of *splendens*.

Mr. CRAIG mentioned *L. formosanum*. I think *L. formosanum* is a very nice Lily for a rock garden and that it is very well placed there. In 1936 in February I sowed seed of what I thought was *L. formosanum Pricei*. In September, 1937, eighteen months later, these all flowered very well. Most of them flowered in my rock garden, and I consider those must be *Pricei*, but one of the batch which had not been planted out, but simply dumped in a frame, grew very tall, and I lifted it and potted it and in September that year it flowered with three stems, the middle stem was 5 ft. 9 in. high with 6 flowers, and the others had three each—twelve flowers on the one bulb after eighteen months. I have given our Chairman a plant which I hope will do me credit, a single stem in a pot. This is the funny thing. All these little plants which I considered to be *Pricei* I am sure will turn out to be *Wilsonii*. I have been completely mistaken in my diagnosis of the species which I had. They are absolutely healthy and disease-free, and we all know that *Wilsonii* is liable to disease. The species I have is apparently going to be perfectly healthy and perfectly strong, and I am going to have a great deal of seed, and shall be very glad to circulate the seed amongst our members.

Mr. ROSE: I am going to say very few words on the subject of Lilies for every garden. To be quite frank I could not say a lot if I tried, but I feel I must be one to throw a brick at my learned friend on my left, and that is on the *L. auratum*. I do not agree that this

is a Lily for every garden. I know that Professor LYTTEL grows it extraordinarily well, and I will tell you the reason why. I have tried it both from purchased bulbs and from seed, and have failed continuously. The reason is that it will start into growth very early in the year, and in a season like this it comes through the ground during the last week in January. When it gets to April it is a foot to eighteen inches high, and if we then as this year get fourteen nights' continuous frost it grips them, and that is where Professor LYTTEL scores. The wood in which we grow our Lilies slopes to the north. There are no evergreen trees to break the wind, and in consequence we suffer badly from the early spring frosts and gales. Miss BARING has also a very exposed garden and she suffers, too, from the frost, terribly. Professor LYTTEL's garden slopes to the south and south-west, and he has a covering of fir trees to help. The consequence is that the frosts from which we suffer do not affect the Professor's garden. The difference between the gardens is such that one might divide the frost we get by six. That is, if we get 6 degrees, Nyewoods would probably have one. Should we get 12 degrees Nyewoods would have two and so on. I remember in the early part of this year Miss BARING and I met and we were commiserating on the enormous amount of damage done to our gardens when Professor LYTTEL said, "Oh, we have had hardly any at all." That is the reason why the Professor's Auratums do so much better than ours!

I am not going to talk any more about Lilies for every garden, but I will admit that I have the Lily fever pretty badly, and I try to grow as many species and hybrids as possible. I have given you my methods before. Raise as many as you possibly can from scales or seeds or get them in any way you can and plant them as our President has advised people to do. Plant some where you think they should grow, plant others where other people think they should grow and some where nobody thinks they will grow. Probably the third place will be the best of all!

As a matter of fact I have no special favourites. I certainly love some better than others, but as this fever has increased in me I have attempted to get as big a collection as I possibly can. I have run up against a good many difficulties, and I thought that I would like to tell you one or two of them. There may be some who are just at the early stages of this fever who may benefit possibly by some of these difficulties I have met. I remember when I first started growing Lilies I ordered a dozen bulbs of *L. bulbiferum croceum*. I planted them out in a herbaceous border and they turned out to be *x elegans*. I did not mind that because it is quite a good Lily for a herbaceous border. Then the fever grew on me, and I had some seedlings given me of *L. Wardii*. I grew them first in a pot and whilst they were quite small I planted them out, and they have flowered—*L. regale*! I badly wanted some *L. Kelloggii*, bought some bulbs and planted them in a specially prepared place. They flowered—they were *L. chalcedonicum*!

Another experience I had later was with a whole quantity of seeds from Japan—*L. cernuum*, *L. concolor*, *L. tsingtauense*, *L. medeoloides*, *L. amabile*, and *L. Maximowiczii*. These were large packets of each. I sowed some, and gave a lot away to friends. The seed germinated well, and the bulbs are now flowering—there must have been a mixture of all these varieties in each packet of seed.

Then *L. Leichlinii*: several plantings have each turned out to be *L. Maximowiczii*.

Now *L. callosum* I had not got, and I badly wanted it. I ordered some; the bulbs came, and they were *L. Parryi*. Lastly, *L. parvum*: I had some sent me in exchange last winter, and they are now coming into flower. I have grown what I thought was *L. parvum* for a number of years. This year they have grown well, a most delightful Lily with very dainty small flowers which are nearly upright.

HYBRID LILIES FOR THE GARDEN.

By F. C. STERN, F.L.S.

In the Lily Year-Book of 1932 Mr. R.W. WALLACE wrote an excellent article on the hybrid Lilies of the past and present. It is a most suggestive article and shows what can be attempted in the hybridization of Lilies. Some of the Lilies he mentions have been lost to cultivation probably because they had poor constitutions and perhaps because the propagation of Lilies by scales was not so well known in the past as it is to-day. In spite of that the hybrid Lilies with good constitutions have remained.

L. × testaceum is probably the doyen of the hybrid Lilies flowering in our gardens to-day. This year is the centenary of the flowering of this Lily and should be celebrated as such. It is still one of the most beautiful Lilies for the garden. It is said to have been found among a parcel of Lily bulbs sent from Holland to a German nurseryman in 1836 and flowered first in 1838. LINDLEY published the name in the Botanical Register in 1842 and Japan was given as the country of origin. Later it was considered to be a hybrid probably between *L. candidum* and *L. chalcedonicum*. This was proved correct when Mr. FRANK JONES of Lechlade made this cross and flowered *L. × testaceum* from the cross. Mr. JONES also made the cross the other way with *L. chalcedonicum maculatum* crossed with *L. candidum*. The seedlings from this cross have flowered and are a light-coloured form of *L. chalcedonicum* which might be called *L. × Beerensii*, Jones's variety. It is a very charming Lily and seems easy to grow under the same conditions as *L. chalcedonicum*, that is in half shade and a good strong loam.

The true hybrid *L. × Beerensii* was shown on June 8, 1938, at the R.H.S. Hall. This hybrid is a cross between *L. chalcedonicum* and *L. × testaceum* and is a lighter and more brilliant-coloured form of *L. chalcedonicum*. It is an old hybrid revived; the original hybrid of this cross was made by Messrs. WARE of Tottenham in 1895.

L. Davidi Willmottiae has been used a great deal by breeders in the crossing of Lilies either as the pollen plant or as the mother plant. Miss PRESTON of Ottawa has obtained four excellent garden Lilies by crossing it with a *L. auriculum* hybrid. 'Grace Marshall,' 'Lillian Cummings,' 'Lyla McCann,' and 'Coronation' are all beautiful Lilies with the grace of *L. Davidi Willmottiae* and flowers shaped like the pollen plant. 'Lillian Cummings' seems to be the strongest grower and the flowers are a remarkable shade of deep reddish-orange. The flowers of 'Coronation' (fig. 13) are quite a break away from the usual colouring

of these hybrids ; the flowers are a bright yellow, a colour quite distinct from the other hybrids. Miss PRESTON also crossed *L. Davidi* with *L. Davidi Willmottiae* and obtained a race of strong and fine hybrids now known as *L. × Davmottiae*. Even if we consider that *Willmottiae* is only a variety of *L. Davidi* it is well worth while crossing the best forms of these two Lilies with each other and thereby to obtain even finer forms than either of the parents.

Mr. F. L. SKINNER of Manitoba, Canada, has also been working on crossing *L. Davidi Willmottiae* with other Lilies. His finest hybrid so far produced is *L. × Maxwill*. This Lily is said to be a cross of *L. Maximowiczii* and *L. Davidi Willmottiae*. It is a magnificent garden plant growing some 7 feet 6 inches high bearing anything up to 20 flowers on a stem ; the flowers are of a Martagon type, orange-red in colour. It has an excellent constitution and has every appearance of making a permanent addition to the number of easily grown Lilies for the garden, especially as it is not fastidious as to soils.

Some people think that *L. × Maxwill* is not a hybrid as it appears to come true from seed ; I am not sure that this is a certain proof. There is, however, a possibility that the *L. Maximowiczii* used by Mr. SKINNER as the parent plant was not *L. Maximowiczii*. It may have been *L. Davidi* as this Lily has had several names since it was first introduced. It was at one time known as *L. pseudotigrinum* with the synonym of *L. Leichlinii* var. *Maximowiczii* and was known as such at Kew when first grown there. If this is so then *L. × Maxwill* would be a cross between *L. Davidi* and *L. Davidi Willmottiae* with *L. Davidi* as the mother plant, just the same cross as *L. × Davmottiae*.

Mr. SKINNER also bred *L. × Scottiae*, a cross between *L. Davidi Willmottiae* and *L. Thunbergianum* 'Mahony.' This cross grows about two feet high and seems to be half way between the parents both in colour and shape of the flowers.

Mr. C. P. RAFFILL has also produced a very fine hybrid *L. × 'Eileen Raffill'*, a strong-growing Lily with a deep orange-red flower which is a hybrid between a good form of *L. Davidi* and *L. × Scottiae*.

L. × Horsfordii, a hybrid between *L. Maximowiczii* and *L. dauricum Batemanniae*, flowers in July. It was raised by Mr. E. H. HORSFORD of Vermont, U.S.A. The flowers are a light apricot-orange with a few orange spots. It grows up to 3 feet in height and is a charming garden plant. By its breeding it will probably do best on a non-lime soil.

There are a number of excellent garden plants which are the result of crossing *L. bulbiferum croceum* with different Lilies. Mr. STOOKE of Hereford has been working at these crosses for some years with great success. *L. × Cromottiae* was the result of crossing it with *L. Davidi Willmottiae* ; the fine Lily *L. × Orange King* was more involved in its parentage—the above cross was hybridized with the same cross. Another cross made by Mr. STOOKE, *L. bulbiferum croceum* × *L. tigrinum splendens* produced *L. × Mangestii*. All these hybrids are said to make excellent garden plants. Mr. SCRASE

DICKINS of Coolhurst also made a *bulbiferum croceum* cross with *L. × elegans* and produced a most beautiful garden plant which is known as the 'Coolhurst hybrid.' This Lily is a strong grower with large golden-orange flowers, a very fine Lily indeed. Its only fault is that it will not grow well in lime soil; this is no doubt due to the blood of *L. × elegans* with which it is crossed. *L. bulbiferum croceum* does not mind lime, but *L. × elegans* dislikes it intensely as do all other Japanese Lilies.

There are now many Martagon hybrids and most of them excellent garden plants, but few of them are more beautiful than the finest forms of *L. Martagon Cattaniae* and *L. Martagon album*. Most of the different Martagon hybrids have been crossed with the yellow *L. Hansonii*. Mrs. BACKHOUSE of Hereford crossed *L. Hansonii* with different forms of *L. Martagon*. This cross produced many fine hybrids and her hybrid 'Golden Orb' received an Award of Merit. Another fine plant *L. × 'Marhan'* was the result of crossing *L. Martagon album* with *L. Hansonii*. This cross was made by Mr. HOOG of Haarlem. The delightful little Lily, *L. pumilum* 'Golden Gleam,' said by some to be a hybrid between *L. Martagon album* and *L. pumilum* is probably a colour form of *L. pumilum*. It comes true from seed.

Mr. ROBERT JAMES of St. Nicholas, Yorkshire, crossed *L. Hansonii* with *L. Martagon album* and has obtained a fine hybrid with a really good yellow flower, which has been named the 'St. Nicholas hybrid.' Mr. R. D. TROTTER of Leith Vale has bred a Martagon hybrid with a pure yellow flower, perhaps the best yellow of any Martagon flower yet seen. Mr. TROTTER tells me this was the result of crossing *Martagon album* with *L. × 'Marhan'* 'Ellen Willmott.'

There is a hybrid race of *L. Hansonii* crossed with *L. Martagon Cattaniae* known as *L. × Dalhansonii* which has deep purple-mahogany flowers; the flowers are larger than the usual type of *L. Martagon Cattaniae*. There have been several fine hybrids of this type shown lately from Lord SWAYTHLING'S garden.

There is a good deal of confusion in gardens to-day with regard to the hybrid trumpet Lilies. Their history is correctly recorded in the different volumes of the Lily Year-Book, but perhaps it might be useful to gather all the information together in this article. *L. × princeps* was the result of *L. Sargentiac* crossed with *L. regale*. This cross was made, according to Miss PRESTON, in 1916. The hybrids flowered at the Ontario Agricultural College in 1919. These Lilies were strong plants, with no bulbils up the stems and varied a good deal. Miss PRESTON, in her article in the 1933 Lily Year-Book, says that there were three distinct plants from this cross and the finest of these was named 'G. C. Creelman.' There is no doubt that 'G. C. Creelman' is a magnificent Lily and a tremendously strong grower in any good loam, or even in lime soils. It flowers a fortnight to three weeks later than *L. regale* and has another advantage that it begins to appear out of the ground also a fortnight or three weeks later than *L. regale*. In this way it escapes the east winds and late frosts

that *L. regale* so dislikes. This Lily can be grown in full sun in places where *L. regale* often gets cut if there is a late frost in April or May. It is of the easiest cultivation and can be grown from scales very quickly. It seems to be quite free from disease. The flowers are after the style of *L. regale* but larger and broader at the mouth. The only fault with this Lily is that with mature plants the flowers are too crowded together on the head.

There are a number of the hybrid *L. × princeps* in different gardens and seedlings from these plants, but none of them is so fine as *L. × G. C. Creelman*. Prof. J. W. CROW continued his work in hybridizing these Lilies.* In order to produce a hardier Lily than *L. myriophyllum superbum* (syn. *L. sulphureum*) he crossed *L. × sulphurale* with *L. × G. C. Creelman*. This cross resulted in many fine Lilies which are known in gardens and in the trade as Crow's hybrids. *L. × sulphurale* was a cross made in Germany by crossing *L. myriophyllum superbum* with *L. regale* as the name suggests. This hybrid is seldom met with in gardens and has been superseded by the 'Crow's hybrids.'

Another race of hybrids have been raised in America and is known as the Shelbourne hybrids—*L. Sargentiae* crossed with *L. regale*. These are fine easy-growing Lilies, but not in my opinion so good as *L. × G. C. Creelman* or the Crow hybrids. A curious phenomenon occurs when these Shelbourne hybrids are raised from seed. Some of the seedlings have flowers with rose-coloured petals on the inside; some are more rosy-coloured than others. It would be worth crossing the plants with the rosiest petals and by selection one day a rose, or even red, trumpet Lily may result.

L. pardalinum hybrids known as the 'Bellingham Hybrids,' were raised at the U.S.A. Agricultural Station at Bellingham in the State of Washington. The late Dr. GRIFFITH selected a few of the many plants raised. He propagated these and distributed them. He says they are all derived from a *L. Humboldtii* cross pollinated with *L. pardalinum*. It is said that the parent plant was a cross of *L. Humboldtii* and *L. Parryi*, but that is not clear. The plants which were distributed have names commemorative of the North-west of the United States—Shuksan, Kulshan, Douglas Ingram, Sacajawea and Star of Oregon. I have not seen all these plants. Shuksan has grown at Highdown in a lime-free bed since 1933 and is a magnificent plant (fig. 11). Two bulbs were planted in 1933. To-day—July, 1938—these bulbs have made eight stems each, 6 ft. 4 in. high, each with about 20 flowers on a stem. The others are no doubt just as good. Douglas Ingram and Kulshan were shown by Mr. CONSTABLE at the R.H.S. Mr. WALLACE in his article in the 1932 Lily Year-Book mentions the *L. pardalinum* crosses made with *L. Parryi* by Mr. BURBANK. It is said that he made thousands of crosses, but there are not many of this cross, which is sometimes known as *L. × Burbankii*, left in gardens to-day. This hybrid is a charming plant, with a flower with yellow predominating

* R.H.S. Journal, 58, 1931.

and the shape is somewhat half-way between *L. Parryi* and *L. pardalinum*, but its constitution appears to be poor. It is a curious fact that if seed is raised from *L. pardalinum* from a garden where these other American Lilies are grown, all sorts of variations appear among the seedlings; however, no really first-class *pardalinum* hybrid has yet appeared. *L. pardalinum giganteum* is a first-rate plant, a tall robust grower with a fine constitution and good sized red flowers, but is it a hybrid? It is said to have been found in a garden in Portland, Oregon. For some time it was considered as a cross between *L. Humboldtii* and *L. pardalinum*, but Mr. GROVE tells me he thinks it is a form of *L. pardalinum*. *L. pardalinum* is a very variable plant and no doubt one day all the different forms, from *L. Rœzlii* at one end to *L. pardalinum giganteum* at the other, will be lumped together as varieties of *L. pardalinum*. There was a most charming hybrid Lily shown at the R.H.S. by Mr. CONSTABLE this year and named *L. × A. J. Harmeling*, a cross of *L. pardalinum* with *L. Washingtonianum*. It has a pale yellow flower flushed with pink at the tips and mottled with deep red spots. If this hybrid has a good constitution it will be a great acquisition to gardens.

L. Henryi is such a strong grower in most soils that it would appear to be an obvious plant to use for hybridization. It is however difficult to get this plant to 'take' when crossed with other pollen. The only hybrid that I have heard of, where *L. Henryi* is the mother plant, was made at Kew by crossing *L. Henryi* with pollen of *L. leucanthum centifolium*. It had a poor constitution and died out. I have tried to make this cross, but have never succeeded in getting good seed. Monsieur DEBRAS of Orleans, that keen Lily enthusiast, was the next to obtain a good *L. Henryi* cross, but he made the cross the other way round. He crossed *L. Sargentiae* with *L. Henryi*; he has named this cross *L. × aurelianense* commemorating the old Roman name of Orleans. This hybrid takes after *L. Henryi* in leaf and growth, but the flower is an open trumpet, the inside of the petals yellow deepening to orange at the base. It seems to be an easy and strong growing Lily with a good constitution. It will be an acquisition to the garden. A still finer hybrid with *L. Henryi* has recently been shown under the name of *L. × T. A. Havemeyer*. The full history of the cross is given by Dr. SOUTT in the Journal of the N.Y. Botanical Garden, October, 1937 (see also p. 158). Mr. TOM BARRY of Lambertsville, N.Y., originally made this cross by pollinating *L. myriophyllum superbum* with *L. Henryi*. This plant is an improvement on *L. × aurelianense* with a better colour and a larger flower. It received an Award of Merit in 1937. Whether it will prove a good garden plant remains to be seen. There is scope for good work to be done by crossing *L. Henryi* on to the different trumpet varieties.

There are two other Lilies that should be mentioned, but they are both likely to do best in a greenhouse. The mysterious and beautiful Lily *L. × 'Mystic'*, which is occasionally shown at the R.H.S., is said to be a cross of *L. leucanthum × L. regale*, but the parentage is

doubtful. It is a very beautiful Lily ; the constitution of this plant is not of the best ; it seems to do well when grown in a greenhouse. It is so charming that it is worth taking trouble about. Another greenhouse Lily is *L. × burnhamense* which is a hybrid, *L. neilgherrense* crossed with *L. Wallichianum*. It combines the good points of both parents.

THE CARNIOLICUM GROUP OF LILIES.

By FRED STOKER, V.-P.L.S., V.M.H.

HOWEVER exact the description of a living plant may be, no true conception of it can be gained without some idea of its past, both as an entity and as an undifferentiated element lying in the womb of its ancestry. Therefore, before describing the units of what is here spoken of as the Carniolicum Group of Lilies, I propose to attempt a brief survey of their possible history.

At the outset, however, some definition is called for. It may be given in these terms: The Carniolicum Group is that European aggregate of Lilies characterized by scattered leaves and Martagon-type flowers and which embraces *Lilium carniolicum*, *L. chalcedonicum*, *L. Heldreichii*, *L. pomponium* and *L. pyrenaicum*. It has an intimate connexion with the N.W. Himalayan *L. polyphyllum* and with such species of Eastern Asia as *L. amabile*, *L. Davidi*, *L. Henryi* and *L. tigrinum*, but is without any close affinity in North America.

An opinion on the time and place of origin of a plant or group of plants and on the forces which controlled its distribution must, in the nature of things, be largely conjectural. In some cases, it is true, a more or less continuous geological record from the remote past to the near present gives what we take to be an approximately true statement of the age and wanderings of a plant, but in genera like *Lilium* which, for one reason or another, have no fossil existence, we are obliged to construct a story that, though its framework is based upon the work of geologists and phytogeographers, must inevitably be charged with surmise.

J. C. WILLIS has very clearly shown that, other things being equal, the age of a plant or genus determines the extent of its distribution; the greater the age, the greater the area covered. As Lilies form a broad zone, only interrupted by seas, round the cool and temperate regions of the northern hemisphere, we may, on WILLIS's dictum, acknowledge their antiquity; and this after making full allowance for the fact that flowering herbs spread more rapidly than trees and shrubs.

In the Lily Year-Book of 1933 (Environment of Lilies) I ventured the opinion that the genus—what there was of it at that distant period—existed in the Eocene in a northern circumpolar belt and was gradually dispersed by the increasing cold that culminated, millions of years later, in the Great Ice Age. No reason has appeared to alter the broad outline of that hypothesis. It should, however, be understood to imply that both during the sojourn of Lilies in the Arctic

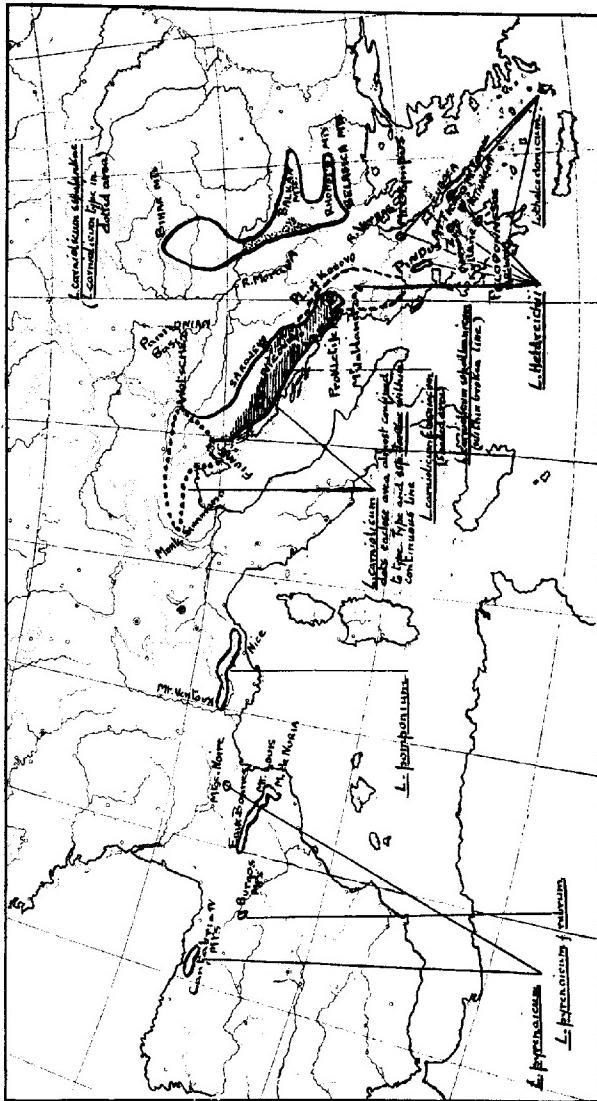


FIG. 14.—MAP OF MEDITERRANEAN AREA SHOWING DISTRIBUTION OF LILIES OF THE CARNIOLICUM GROUP.

and Subarctic and during their migration southwards new groups and species were evolved.

Let us postulate that, among the migrants, a Precarniolicum division originated. That it appeared later than the Leucolirions, Isolirions and whorl-leaved Martagons (all of which are represented in both New and Old Worlds) is suggested by its never reaching America. The genus, one supposes, had already split into western and eastern parts and the latter was far advanced on its southern journey before the birth of the Precarniolicums occurred within its ranks : but not too far to prevent the new group from penetrating both Asia and southern Europe. (The Precarniolicum group, I am assuming, gave issue to the Asiatic scattered-leaved Martagons as well as the European aggregate of Carniolicums).

Further theorizing on the origin and fate of the entire ancestral tribe is unprofitable for our present purpose, but we may with interest pursue the conceivable adventures of the European branch.

One pictures the intact and as yet undifferentiated assemblage being checked in its southward-tending journey by the Carpathians and the stretch of water which extended from the Carpathians to the Caucasus in the Pleistocene period. There was, however, an avenue of escape from the advancing cold between the Carpathians and the Eastern Alps and through it, one presumes, a portion of the Lilies passed to find harbourage eventually in the Balkan countries, the north-eastern Adriatic lands and Hungary. The pioneers in the movement comprised that section of the whole which eventually gave rise to *L. chalcedonicum*, *L. Heldreichii* and *L. albanicum* if, that is, one may judge from the present stations of those descendants. Following their leaders, the great mass of the European Precarniolicums took advantage of the opening and, in the course of time, were shaped into *L. carniolicum*, *L. carniolicum* subsp. *Jankae* and *L. carniolicum* f. *bosniacum*. A residuum, instead of passing through the gap, to escape the cold, rounded the northern margin of the Alps, turned southwards to continue its course between the western Alps and the Cevennes, threw off a detachment into south-western France and the adjoining part of Italy and came to rest in the Pyrenees and north of Spain.

This theory of distribution may appear too fanciful without some concrete testimony to back it. But, in the want of fossil evidence, what concrete testimony can there be ? May we not allow that the meteorological phenomena and geographical disposals which so profoundly influenced the dispersal of other plants had a like effect on Lilies ?

And what other suggestions can be advanced ? That each species was evolved in its present situation ? That the several species originated elsewhere, but by an extraordinary series of accidents reached neighbouring homes ? The very enunciation of such proposals is sufficient to indicate their unlikelihood.

There is a trite but just saying to the effect that when a judgment

is arrived at from circumstantial evidence, the more closely that it approaches probability the more is it likely to be true. The criterion of probability, we may agree, justifies at least the provisional acceptation of the thesis propounded.

The members of the Carniolicum group all inhabit alpine or sub-alpine territories in Nature and so prejudiced is their inherited appetite for the conditions prevailing there that they are, in the mass, usually very reluctant to accept those of cultivation. Not infrequently, however, we read that *L. chalcedonicum* and *L. pomponium* are amongst the easiest of their genus; they have even been known to appear in those attractive lists cunningly entitled "Lilies for the Beginner." Gardeners, unfortunately, have not found that their behaviour corresponds to such excellent testimonials. *L. carniolicum* is rarely seen in cultivation and its subspecies more rarely still. *L. pomponium* seldom maintains its size and numbers for more than a few years, and a good group of *L. chalcedonicum* or *L. Heldreichii* is not a common sight. *L. pyrenaicum* alone is reasonably tolerant of the average garden, but only reasonably tolerant. When it displays signs of automatic spread the occasion is deemed one for the clashing of cymbals.

The resemblance that the members of the Carniolicum group bear to one another is reflected in their synonymy. It will be seen below that the name *L. pyrenaicum* has, in different hands, served for *L. Jankae* and *L. albanicum*, that *L. chalcedonicum* has covered *L. albanicum*, *L. carniolicum* and *L. pyrenaicum* and that *L. carniolicum* was described by at least one botanist as a variety of *L. pomponium*. In short, on the axiom that things that are equal to the same thing are equal to one another, all the Lilies with which we are now concerned might be reduced to one species if their synonyms expressed facts.

But besides indicating resemblances this common denominating has caused, and still causes, perplexity. So disturbed were botanists of the rank of BECK and KERNER by the state of affairs that they determined to make order where no order was. In the effort they went a little too far; they gave what we now recognize as variants specific rank. Nevertheless, the names they and others gave took root, and to this day it is very easy to gain the impression that, for example, *L. Jankae* and *L. bosniacum* are good species. This is far from being the case. The late Professor KÖSANIN, whose knowledge of the Carniolicum group was perhaps unequalled, asserted, indeed, that *L. carniolicum* and (in modern nomenclature) its subspecies *Jankae* are really one and the same thing. He also held that *L. bosniacum* was a form of *L. carniolicum* or, alternatively, a hybrid between *L. carniolicum* and *L. albanicum*, and that *L. albanicum* was a good species. Acceptance of KÖSANIN's views, and it is difficult to oppose them, must lead to an alteration in the nomenclature of the plants concerned. In this contribution, however, accepted names are adhered to and possible changes, and the reasons for them, only discussed under the Lilies involved.

As in the past different authors have given different values to certain terms in describing Lilies, it may be well to say that, as used below, the following words are intended to bear the meanings appended :

- peduncle = the whole length of a flower stalk arising from the main axis.
- raceme = that part of the main axis from which the peduncles arise.
- versatile = applied to anthers that move freely on their stalks (filaments). Thus a single versatile anther may, at different moments of its life, face the centre of the flower, face outwards, swing horizontally or assume any intermediate position.

CHARACTERS HELD IN COMMON BY THE CARNIOLICUM GROUP.

BULBS made up of overlapping scales.

STEMS erect, rounded, rooting (not in the way that, e.g. *L. auratum* is stem-rooting, but only to a small degree).

LEAVES scattered, sessile, punctate below, glandular-ciliate at margin.

INFLORESCENCE racemose ; peduncles single-flowered.

FLOWERS, except for those of *L. chalcedonicum* and *L. Heldreichii*, smell of green vegetation in the first stage of decay. Martagon-shaped. Segments tipped and, at their bases, fringed with glandular cilia. Nectariferous furrows smooth-edged. Anthers versatile, pinkish-buff in colour, i.e., before they split and expose the pollen which, in every case, is bright red. Filaments awl-shaped, slightly flattened at base. Stigma trilobed ; together with style forms a club-shaped structure. Style smooth. Ovary cylindrical and, as in other groups of the genus, 6-ridged and trilocular.

CAPSULES. Shape and size not constant and dependent upon water supply and vigour of plants. (Descriptions given can only be taken as rough guides.)

LILIES COMPRISING THE CARNIOLICUM GROUP.

L. CARNIOLICUM Bernh. ex Koch, Syn. Fl. Germ. ed. I, 708 (1837) (fig. 15).

Synonyms* : *L. chalcedonicum* Linn. Sp. Pl. ed. ii, 434 (1762) in part ; Jacq. in Fl. Austr. Suppl. 5, 37, t. 20 (1778).

L. pomponium var. *carniolicum* Fiori, Nuova fl. anal. d'Ital. 251 (1923).

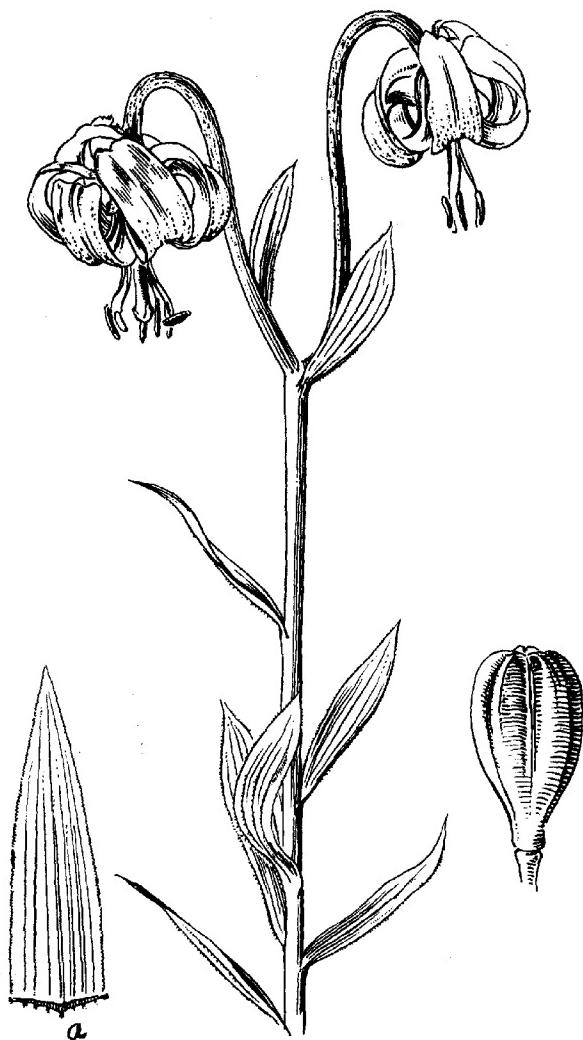
L. carniolicum subsp. *eu-carniolicum* Hayek & Markgraf, Prodromus fl. Balc. 3, 61 (1932).

For reasons given under *L. carniolicum* subsp. *Jankae*, only plants with red (or orange) flowers are here considered as true *L. carniolicum*.

DISTRIBUTION : (Taken from reports by ASCHERSON & GRAEBNER, HAYEK, HEGL, PAULIN, GORTANI, FIORI, ROSSI, PAMPANINI and KOSANIN).

From a northern dispersal through the Venetian and Julian Alps, the Karawanken and N.W. Yugo-Slavia (Carniola and N. Croatia) it spreads southwards through W. Yugo-Slavia to the

* Only synonyms published after the issue of Linnaeus's Species Plantarum in 1753 are given in this contribution.

FIG. 15.—*L. CARNIOLICUM*.

Flowers and foliage stem \times about $\frac{1}{2}$. Capsule \times about $\frac{3}{4}$.
a = Portion of a leaf to show ciliated veins on lower surface;
semi-diagrammatic.

Prokletije Mountains in N. Albania. The northern part of this area (Venezia, Carinthia, Carniola, N. Croatia, limited to the south by a line from just south of Fiume to Wotsche) is given, as between the type and the subsp. *Jankae*, almost entirely to the type *L. carniolicum*. The southern part is shared by both. Found also in eastern Yugo-Slavia though there the subspecies *Jankae* predominates.

SPECIMENS EXAMINED : 6 fresh; 1 dry.

BULB. Ovoid; 3" long, 2½" in diameter (approx.); yellowish on exposure.

Scales ovate or ovate-lanceolate; acute.

STEM. From 12" to 36" high; usually green; smooth; slightly ridged below.

LEAVES. From 30 to 40; ascending-spreading; lanceolate; acute or subacute or tapering to a sharp or blunish point; 2"-3" long, ½"-¾" wide; nerves 5-7; glandular-ciliate on nerves beneath.

INFLORESCENCE. 1-6 flowers; peduncles 2"-6" long, green often purple-spotted, smooth, curved downwards towards attachment of flowers, usually bracteolate.

FLOWERS. Open in late May and June; characteristic smell; perianth recurved for over two-thirds of length; about 2½" across; light red or orange, tinged green on outer surface (strongly at base) and on lower third of inner surface; lower two-thirds inner surface marked with short, raised, dark purple lines; perianth segments 2½" long, ¾" broad, narrow to slightly callous tips; outer segments oblanceolate, slightly keeled; inner segments lanceolate, keeled, present wart-like projections within at level of throat and in relation to outer end of nectariferous furrows; nectariferous furrows green, shallow. Anthers ½"-¾" long; filaments light green, smooth, 1"-1½" long. Style rounded below, triangular above, together with stigma about ½" long. Ovary smooth, about ½" long.

CAPSULE. Oblong, obovoid or top-shaped, apex depressed, 6-angled, angles usually rounded and sometimes buttressed above; up to 1½" long and ½" diameter.

L. CARNIOLICUM subsp. *JANKAE* (Kern.) Ascher. & Graeb., *Syn.*, 3, 181 (1905) (fig. 16).

Synonyms: *L. Byzantium flore flavo* Bauhin ex Mill. *Gard. Dict.* ed. 4, no. 19 (1754).

L. pyrenaicum Baumg., *Enum. Stirp. Transilv.* I, 301 (1810).

L. albanicum Heuff. in *Verh. Zool. Bot. Ges. Wien*, VIII, 209 (1858).

L. Jankae Kern., *Österr. Botan. Zeitschr.* XXVII, 402 (1877).

L. carniolicum f. *sulphureum* Pampan., adjunc. schedae no. 17 (*L. carniolicum* Bernh.) Fl. Ital. exsicc. Nuovo Giorn. Bot. Ital. n.s. 12, 151 (1905).

In the French summary attached to Kösanin's "Systematic Standing and Geographical Distribution of *LL. albanicum* and *carniolicum*" in *Għlas Srpske Kral'evske Akad.*, CXXII, *Prvi Razred* 56, he (Kösanin) argues that as the distinction between *L. carniolicum* and *L. Jankae* rests on the colour of their flowers which, in the types, are red (or orange) and yellow respectively, the fact that *L. carniolicum* may bear yellow flowers renders any reason for separating *L. Jankae* from *L. carniolicum*, either as a variety or geographical form, non-existent.

FIG. 16.—*L. CARNIOLICUM* subsp. *JANKAE*.

Flowers and foliage stem \times about $\frac{1}{2}$.
a = Portion of a leaf to show ciliated veins on lower surface; semi
diagrammatic.

But if *L. Jankae* is morphologically identical with *L. carniolicum*, but of a yellow colour, then it is clear that a yellow *L. carniolicum* is actually *L. Jankae*. In this light, not only does KÖSANIN'S refusal to give *L. Jankae* even varietal rank appear too drastic, but our continuing to credit *L. carniolicum* with ever bearing yellow flowers is, if not an error, at any rate out-of-date.

As in the preparation of this contribution no morphological difference that could be considered constant was found between the Lilies, *L. Jankae* is looked upon as, but not so designated, a yellow variety of *L. carniolicum*. In contemplation of the fact, however, that it exhibits only a colour variation from the type species, a varietal rank would be more appropriate to it than a subspecific one.

DISTRIBUTION: (Extracted from reports by KÖSANIN, ASCHERSON & GRAEBNER, HEUFFEL, ADAMOVIC, SCHACHT and JÁVORKA).

WESTERN AREA: From south of the Fiume-Wötsche line (rarely north of it) to the Prokletije Mountains. (See under *L. carniolicum*.)

EASTERN AREA: From the Bihar Mountains (N.W. Rumania) through Bulgaria and eastern Yugo-Slavia to the Belasica Mts. on the Yugo-Slavian—Macedonian frontier.

It may be seen on the map (fig. 14) that the eastern area, which represents the principal distribution of *L. Jankae*, is separated from the western and from the northern distribution of *L. carniolicum* by, from south to north, the Vardar valley, the Morava valley and the Pannonian basin.* The point is interesting as illustrating the avoidance of low ground by the Carniolicum Group.

SPECIMENS EXAMINED: 2 fresh ; 6 dry.

BULB. Like that of *L. carniolicum*.

STEM. From 12" to 27" high, usually green, smooth, slightly ridged.

LEAVES. From 50 to 70; ascending or ascending-spreading, lanceolate or ovaite-lanceolate, acute, or subacute or, in the upper ones, tapering to a sharp or blunish point, 1½"-3½" long, ½"-1" wide, largest and most numerous in middle third of stem, punctate above; veins 7-9, glandular-ciliated on lower plane of leaf but less prominently so than in *L. carniolicum*.

INFLORESCENCE. 1-6 flowers; peduncles 2½"-7" long; green, minutely punctate, smooth, curved downwards or outwards towards attachment of flowers; usually bracteolate.

FLOWERS. Open in early June; characteristic smell; perianth recurved for over two-thirds of its length, 1½"-2" across, bright yellow (except for lower fourth of outer surface which is green) marked with raised, brown purple spots and lines on middle two-fourths of inner surface, but sometimes unspotted (Lemperg). Perianth segments 2½" long, ¼" wide, all lanceolate and tapering to slightly callous tips; inner segments keeled, outer less distinctly so, warty elevations in relation to outer ends of nectariferous furrows, especially marked on inner segments; nectariferous furrows shallow. Anthers ¼"-¾" long; filaments

* Pannonia was an old Roman province bounded to the east and north by the Danube and now forms, roughly, the western half of Hungary and the Styrian part of Austria.

yellowish-green, smooth, about $1\frac{1}{2}$ " long. *Style* and *stigma* as in *L. carniolicum* and together from $\frac{3}{8}$ " to $\frac{3}{4}$ " long. *Ovary* from $\frac{5}{8}$ "- $\frac{3}{4}$ " long, smooth.

CAPSULE as in *L. carniolicum*, but slightly less in diameter.

L. CARNIOLICUM forma *BOSNIACUM* (Beck) Kös. in *Glas Srpske Kraljevske Akad.*, cxxiii, *Prvi Razred* 56, p. 46 (1926).

Synonym : *L. bosniacum* Beck ex Fritsch in *Mittiel. Naturw. Ver. Steiermark*, XLIX, 163 (1900); nomen.

DISTRIBUTION : Mountain ranges in western Yugo-Slavia (from S. Croatia to Montenegro).

(Taken from the reports of KÖSANIN, HAYEK, BECK, JÁVORKA and PANČIĆ.)

As has been mentioned, KÖSANIN looked upon *L. bosniacum* as either a form of *L. carniolicum* or as a hybrid between *L. carniolicum* and *L. albanicum*. While *L. carniolicum* (type and subsp. *Jankae*) meets *L. albanicum* in N. Albania and S. Yugo-Slavia and *L. bosniacum* is found in that area, it (*L. bosniacum*) also extends much farther northwards than does the distribution of *L. albanicum*. Moreover, in the limited number of specimens examined, *L. bosniacum* showed no character for which *L. albanicum* could be held as undoubtedly responsible. One inclines, therefore, to the opinion that *L. bosniacum* is a form of *L. carniolicum*.

SPECIMENS EXAMINED : 1 fresh ; 2 dry.

BULB. Not seen.

STEM. 10"-14" high, green, smooth, slightly ridged.

LEAVES. From 30 to 50, ascending or ascending-spreading, largest below, lanceolate or ovate-lanceolate, lower acute or subacute, upper taper to a sharp point, $1\frac{1}{2}"$ - $2\frac{1}{2}"$ long, $\frac{3}{4}"$ - $1\frac{1}{2}"$ wide; veins 5-9, glandular-ciliate on lower surface of leaves but patchily and less prominently than in *L. Jankae* (and therefore much less prominently than in *L. carniolicum*) ; minutely punctate on upper surface.

INFLORESCENCE. 1-3 flowers ; peduncles 3"-4" long, smooth, minutely punctate, suberect or curved horizontally towards attachment of flower, bracteolate.

FLOWERS. Open in June ; characteristic smell ; perianth recurved for two-thirds or more of its length ; $1\frac{1}{2}"$ - $1\frac{3}{4}"$ across ; bright yellow (or, according to report, rarely red or orange), marked with raised, brown purple spots and lines or blotched in throat ; segments $1\frac{3}{4}"$ - $2\frac{1}{2}"$ long, $1\frac{1}{2}"$ - $1\frac{1}{2}"$ wide ; outer segments ob lanceolate, acute, slightly channelled at apex, slightly keeled ; inner segments lanceolate, scarcely acute, distinctly keeled and bearing wart-like outgrowths in relation to outer ends of nectariferous furrows. Nectariferous furrows shallow, green at base, purplish distally. Anthers $\frac{1}{2}$ " long. Filaments pale green, smooth, 1" long. Stigma and style not developed in the fresh specimen examined and lost from the dried ones. Ovary $\frac{1}{2}"$ long (dry specimen).

CAPSULE. Not seen.

A variant of this Lily named by BECK *L. carniolicum* var. *bosniacum* f. *stenophyllum* (*Glasnik. Zem. Muz. u Bosn. i Hercegov.* 15, 206 (1903)) is said to be characterized by very narrow linear-lanceolate

leaves, the lower not being more than $\frac{3}{8}$ " wide and the upper $\frac{5}{8}$ " in the same dimension. It occurs, according to Rossi, in the Velebit range and, to Schiller, in the Ljubična Mts. (near that corner where the old countries of Bosnia, Hercegovina, Montenegro and Serbia met). I have not seen it.

L. CHALCEDONICUM Linn. *Sp. Pl. ed. i*, 302 (1753) in part. (Fig. 17).
Synonym : *L. Byzantium minutum* Bauhin ex Mill. *Gard. Dict. ed. iv.*
no. 17 (1754).

DISTRIBUTION : Greece. (Thessaly : Mt. Olympus ; Euboea ; Peloponnesus.)

(According to HELDREICH, LEMPERG, ATCHLEY and W. E. TH. INGWERSEN, each of whom records one or more of the above localities.)

SPECIMENS EXAMINED : 8 fresh.

BULB. Broadly ovoid, about 3" in length and in diameter, yellowish. Scales broadly lanceolate, acute or subacute.

STEM. 24"-48" high, green or suffused with purple below, slightly ridged, sparsely puberulent.

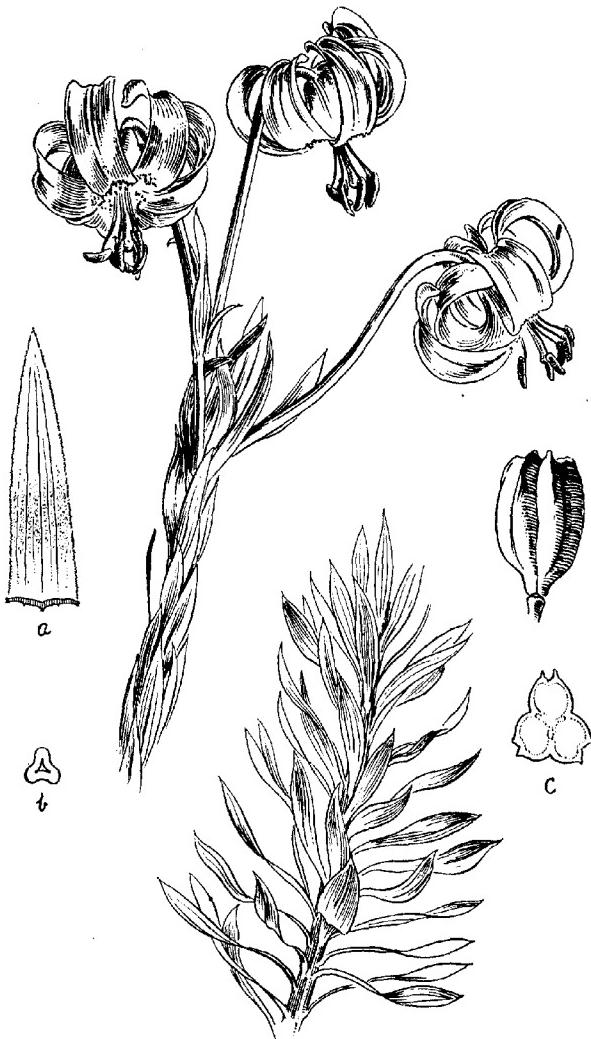
LEAVES. Very numerous, change abruptly in character and disposition in upper half (+ or —) of stem. Lower leaves spreading or ascending-spreading, usually twisted one-eighth of a turn in distal third, lanceolate or oblanceolate, acute or subacute or sometimes tapering to a sharp or bluntnish point ; $3\frac{1}{2}''$ -4 $\frac{1}{2}$ " long by $\frac{1}{2}''$ - $\frac{5}{8}$ " wide ; sparingly punctate on upper plane ; silver-margined (with three or four rows of cilia) ; veins 7-9 ; central vein glandular-ciliate on lower surface, laterals less prominently so and often irregularly. Upper leaves more or less closely appressed to stem, lanceolate, ovoid-lanceolate or obovate, acute, $1\frac{1}{2}''$ -1 $\frac{1}{2}$ " long, $\frac{1}{2}''$ - $\frac{3}{8}$ " wide ; veins 3-7, centrally ciliate, laterals usually nude ; edge as in lower leaves.

INFLORESCENCE. Umbellate in character ; 6 or more flowers ; peduncles 3 $\frac{1}{4}$ "-6" long, green, sometimes spotted purple, slightly papillose, curved downwards towards flowers, usually bracteolate.

FLOWERS. Open in July ; very faint but agreeable smell ; perianth recurved for over three-quarters of length, 2"-2 $\frac{1}{2}$ " across, orange-vermilion within, vermilion-orange without, suffused olive-brown at base ; raised lines and spots in throat which become pedunculated in relation to outer ends of nectariferous furrows particularly on inner segments ; nectariferous furrows shallow, olive-tinted. Perianth segments 2 $\frac{3}{4}$ "-2 $\frac{1}{2}$ " long, $\frac{9}{16}''$ - $\frac{3}{4}$ " wide (inner may be slightly narrower than outer) ; outer segments lanceolate or ovate-lanceolate, subacute, tip callous and channelled ; inner segments lanceolate, keeled, tip bluntnish, callous and channelled. Anthers $\frac{3}{8}''$ - $\frac{1}{2}$ " long. Filaments smooth, pale yellow, 1 $\frac{1}{2}''$ -1 $\frac{1}{2}$ " long. Style trilobed in transverse section, together with stigma $\frac{7}{16}''$ - $\frac{9}{16}$ " long. Ovary $\frac{7}{16}''$ - $\frac{9}{16}$ " long.

CAPSULE. Obovoid, apex depressed; 6-angled ; angles rounded below but in upper part of capsule slightly winged and so arranged as to give it a 3-lobed appearance, each lobe consisting of two approximated angles ; 1 $\frac{1}{2}$ " long, 1" broad.

There is a form in which the raised spots within the throat are coloured purple. It used to be included in descriptions of the type, (tab. 30 in Bot. Mag. represents it), the marking being considered casual and liable to occur in any individual. As, however, the attribute

FIG. 17.—*L. CHALCEDONICUM.*

Flowers and upper part of stem \times about $\frac{1}{2}$. Lower part of foliage stem \times about $\frac{1}{4}$. Capsule $\times \frac{1}{12}$.

a = Portion of leaf to show, on lower surface, definite ciliation on central vein and sparing ciliation on laterals; semi-diagrammatic.

b = Transverse section of style; semi-diagrammatic.

c = Transverse section of capsule to show arrangement of angles.

appears to be hereditary* plants with spotted flowers are now known in gardens by the varietal name *maculatum*. In order to give this name validity, the bearers of it may be thus described :

L. CHALCEDONICUM var. MACULATUM, *punctis purpureis minutis intus maculatum*.

L. HELDREICHII Freyn (*litt. ad Heldr. majo 1879*) in *Flora*, LXIII, 28 (1880). (Fig. 18).

Synonyms : *L. chalcedonicum* Sibth. & Sm. ? ex Nyman, *Conspl.* 4, 721 (1882).
 \ *L. carniolicum* Heldr. ex Freyn in *Flora*, LXIII, 28 (1880).

DISTRIBUTION : Albania : Mt. Jablanitza.

Greece : Thessaly : Mt. Olympus ; Foothills of Pindus range.

Attica : Kitháron, Parnassus, Parnes range. Peloponnesus : Kyllene.

(According to HELDREICH, LEMPERG, ATCHLEY and W. E. T. INGWERSEN, each of whom has reported the plant from one or more of these situations.)

SPECIMENS EXAMINED : 8 fresh.

BULB. Broadly ovoid, about 3" in horizontal diameter, a little less in vertical, white or yellowish. Scales broadly ovoid or obovoid, acute (usually) or blunt.

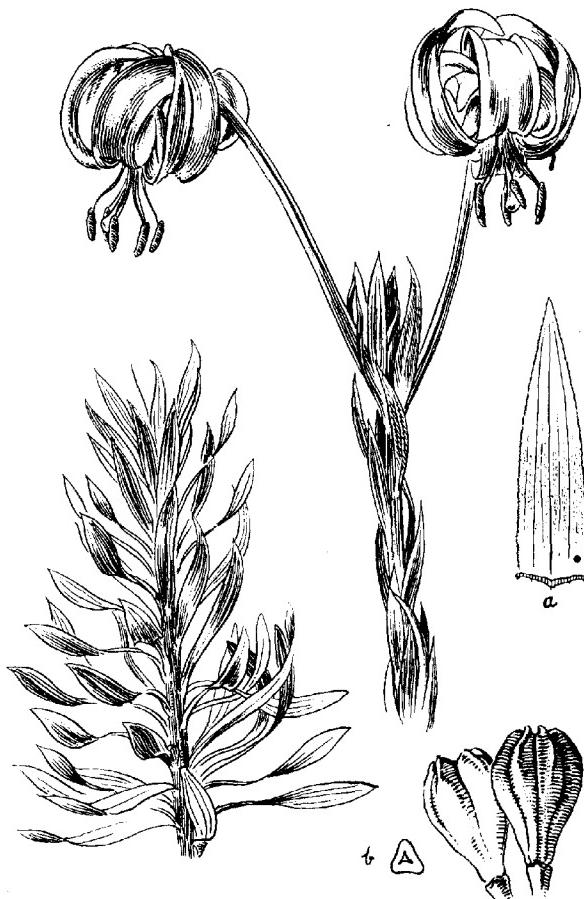
STEM. 18"-24" high (or more ?) ; green, often suffused with purple below and speckled above ; sometimes purple for nearly whole length ; sparsely puberulent below, smooth above ; slightly ridged.

LEAVES. Very numerous ; change in character and disposition in relation to position on stem similar to those of *L. chalcedonicum* q.v. ; lower leaves spreading or ascending-spreading, usually twisted through one-eighth of a turn in distal third, linear-lanceolate, lanceolate or oblanceolate, acute (usually) or subacute ; 3"-4" long, $\frac{1}{2}''-\frac{5}{8}''$ wide ; veins 7-9, central ciliated on lower surfaces of leaves, laterals minutely so ; veins on lowermost leaves often nude. Upper leaves more or less closely appressed to stem, lanceolate, acute, $1\frac{3}{4}''-1\frac{1}{4}''$ long, $\frac{3}{8}''-\frac{5}{16}''$ wide ; veins 5-7, the central minutely ciliate on lower surface. The silver margin of the leaves is less marked than in *L. chalcedonicum*, which means that the marginal cilia are not so prominent.

INFLORESCENCE. Umbellate, 1-5 flowers. Peduncles 3"-5" long, curved downwards towards flower, minutely and sparsely papillose, seldom bracteolate.

FLOWERS. Open in July a little later than those of *L. chalcedonicum* ; faint but agreeable smell ; recurved for over three-quarters of length ; about 2" across ; orange-vermilion within, vermilion-orange and often with a broad, central, lighter band on outer segments without, suffused olive-brown at base ; lower half of recurved portion shows raised lines and spots which, in relation to outer ends of nectariferous furrows, become pedunculated, especially on inner segments. Nectariferous furrows olive-tinted, very shallow in outer segments. Perianth segments $2\frac{1}{2}''-3''$ long, $\frac{9}{16}''-\frac{11}{16}''$ wide, the outer a trifle longer and wider than the inner ; outer segments lanceolate, acute, tip greenish, callous and channelled ; inner segments lanceolate, keeled, bluntnish, tip callous and channelled. Anthers $\frac{3}{8}''-\frac{7}{16}''$ long. Filaments $1\frac{1}{4}''-1\frac{7}{16}''$ long, pale yellow, smooth, more slender than in *L. chalcedonicum*. Style roughly

* G. M. TAYLOR in Lily Year-Book, (1932) 77.

FIG. 18.—*L. HELDREICHII.*

Flowers and upper portion of stem \times about $\frac{5}{8}$. Lower part of foliage stem \times about $\frac{1}{2}$. Capsule $\times \frac{3}{2}$.

a = Portion of leaf to show, on lower surface, ciliated central vein and minutely ciliated laterals; semi-diagrammatic.

b = Transverse section of style; semi-diagrammatic.

triangular with blunted angles and slightly concave sides, together with *stigma* $\frac{3}{4}$ "– $\frac{5}{8}$ " long. Ovary $\frac{1}{2}$ "– $\frac{3}{4}$ " long.

CAPSULE. Shaped like that of *L. chalcedonicum* but narrows more gradually towards base and only $1\frac{1}{4}$ " long by $\frac{3}{8}$ " diameter.

The minor differences given as existing between *L. chalcedonicum* and *L. Heldreichii* do not appear sufficient to justify specific separation of the two. FREYN, moreover, in his original description of *L. Heldreichii* does not mention any characteristic that might not be as readily assigned to *L. chalcedonicum*. At the same time, the contrasts between their respective bulbs, their upper leaves, their styles, the usual presence of bracteoles on the peduncles of *L. chalcedonicum* and their usual absence in *L. Heldreichii* prevent us from regarding the plants as identical. The circumstances suggest, indeed, that the grading of *L. Heldreichii* as a variety of *L. chalcedonicum* would be appropriate.

L. CARNIOLICUM subsp. *ALBANICUM* (Griseb.) Hayek (*Prod. Fl. Balc.*) in Fedde, *Repert.* XXX, III, 62 (1932).

Synonyms : *L. pyrenaicum* Griseb., *Reise* 2, 304 (1841).

L. albanicum Griseb., *Spic. fl. Rum. et Bith.* 2, 385 (1844).

Nymam, *Conspl.* 721. Richter, *Pl. Eur.* I, 211, z.t. (1890).

L. chalcedonicum var. β *albanicum* Asch. & Graeb. *Syn.* 3, 183 (1905).

The last synonym indicates the belief of ASCHERSON & GRAEBNER that this Lily was closely related to *L. chalcedonicum*. If, however, we are to believe, as KÖSANIN appeared to do, that the sign of close affinity between members of the Carniolicum group is the presence of glandular cilia on the veins on the lower surface of the leaves, *L. albanicum* is not intimately allied with *L. chalcedonicum*, but with *L. pomponium* and *L. pyrenaicum*. Further, on account of the absence of ciliated veins on its leaves, it does not appear correctly graded as a subspecies of *L. carniolicum*, but might properly be restored to the specific rank given it by GRISEBACH and confirmed in 1926 by KÖSANIN.

DISTRIBUTION : (From reports by KÖSANIN, HAYEK, BOISSIER, VISIANI, PANTOČEK and LEMPERG).

Mountainous regions in W. Macedonia, Albania and S.W. Yugo-Slavia from the Pindus Mts. in the south to Niković (a little north of Mt. Durmitor) in the north and bounded to the east by the valley of the Vardar and plain of Kosovo.

SPECIMENS EXAMINED : 2 fresh ; 16 dry.

BULB. Ovoid, up to 2" long by $1\frac{1}{8}$ " wide ; purplish on exposure. Scales lanceolate, acute.

STEM. 7"-24" high, green spotted purple below, smooth or irregularly puberulent.

LEAVES. From 30-50 ascending, most thickly disposed in middle three-fifths of stem, largest below ; the lower lanceolate, ovate or oblong, acute or blunt, the upper lanceolate or linear-lanceolate and tapering to a point, punctate on upper plane; 1"-2 $\frac{1}{2}$ " long, $\frac{1}{16}$ "– $\frac{3}{8}$ " wide. Veins 7, not glandular-ciliate on lower plane.

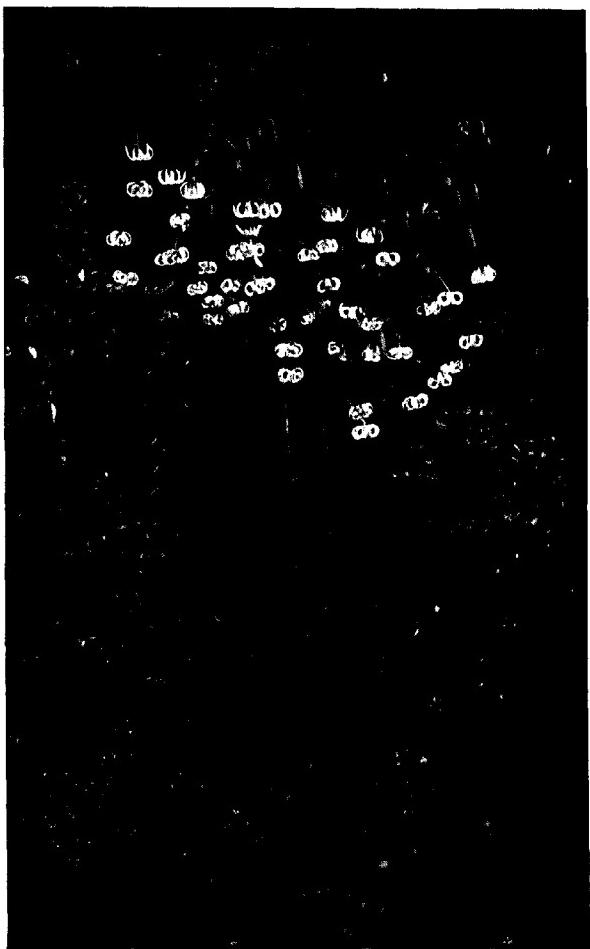


FIG. 19.—LILICUM WARDII IN MR. G. H. DALRYMPLE'S GARDEN, BARTLEY.
(p. 171.)

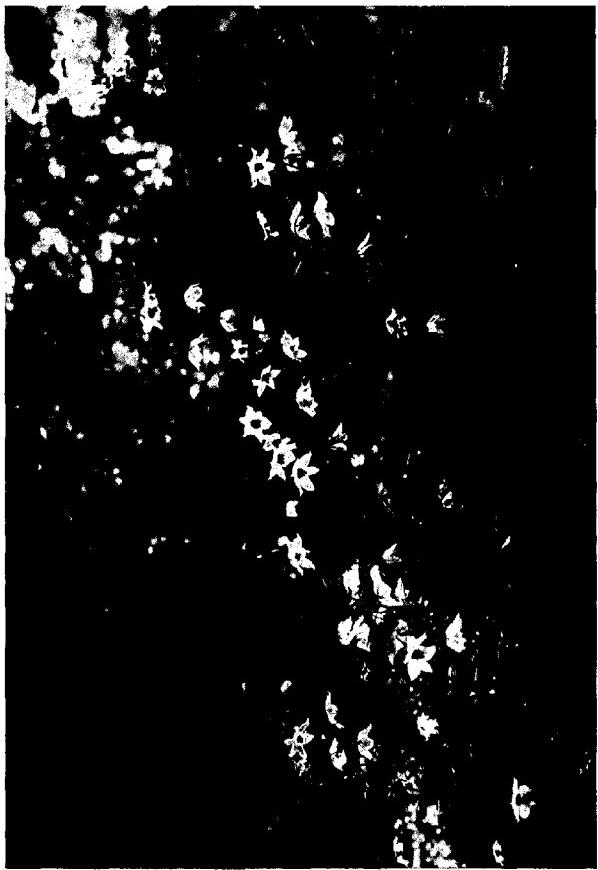


FIG. 20.—*NOMOCHARIS PARDANTHINA* IN COL. STEPHENSON CLARKES' GARDEN.
(p. 159.)

INFLORESCENCE. 1-4 flowers. *Peduncles* 1 $\frac{1}{2}$ -3" long, green, often spotted purple, minutely papillose, may be erect on single-flowered plants, otherwise bent horizontally or downwards towards attachment of flowers; bracteolate.

FLOWERS. Open about middle of June; faint but typical smell; perianth recurved for over two-thirds of length; 1 $\frac{1}{2}$ " or less across, bright yellow, tinged purple on outer surface, wart-like elevations and raised lines which may be coloured purple at level of throat. Red and orange flowers are also reported. These, according to Kýsanin, are always purple spotted. *Perianth segments* 1 $\frac{1}{2}$ -1 $\frac{1}{2}$ " long, $\frac{3}{16}$ "- $\frac{5}{16}$ " broad; *outer segments* oblanceolate, acute, slightly keeled, tips a little callous; *inner segments* lanceolate or oblong-lanceolate, definitely keeled, tip subacute and callous beneath. *Nectariferous furrows* wide and shallow. *Anthers* $\frac{1}{2}$ "- $\frac{5}{16}$ " long. *Filaments* pale yellow, minutely glandular-papillose, $\frac{3}{16}$ "- $\frac{7}{16}$ " long. *Style* triangular on transverse section, together with *stigma* $\frac{3}{8}$ " long. *Ovary* $\frac{3}{8}$ " long.

CAPSULE. Not seen.

L. POMPONIUM Linn. Sp. Pl. ed. 1, 302 (1753) in part. (Fig. 21).

Synonyms: *L. miniatum odorum angustifolium* Bauhin ex Mill. *Gard. Dict.*, ed. iv., 2, no. 10 (1754).
L. angustifolium Mill. *ibid.* ed. viii., no. 6 (1768).
L. rubrum Lam. & DC. *Fl. Franc.* 3, 202 (1805).
L. pomponium var. α Ker-Gawl. *Bot. Mag.* sub t. 971 (1807).
(Flowers of *L. pyrenaicum rubrum*.)

DISTRIBUTION: Mountainous regions in (1) S.E. France in Departments of Drôme, Vaucluse, Basses Alpes, Var and Alpes Maritimes. (2) N.W. Italy in S.W. Piedmont and Liguria.

(Extracted from the works of VILLARS,* ARDOIXO, ROUY, GRENIER & GODRON, and BICKNELL and communicated by modern collectors.

Linnaeus gave as habitats the Pyrenees and Siberia. The second of these probably refers to a Siberian species (*L. pumilum*?) mentioned by GMELIN [Fl. Sibirica, I, 42 (1747)] and the first undoubtedly to *L. pyrenaicum*. *L. pyrenaicum*, indeed, was confused with *L. pomponium* until the present century; in the Bot. Mag. t. 971, Ker-Gawler depicts flowers of *L. pyrenaicum rubrum* and the foliage of *L. pomponium* under the title of the latter; there is a reference to Palau's mention of *L. pomponium* (the accuracy of the diagnosis being questioned by the authors) being found in the Mts. of Burgos in WILLKOMM's and LANGE's Prod. Fl. Hispan. I, 221 (1870); Blas Lazaro e Ibiza, in his Fl. Española I, 155 (1920) gives the same situation (Mts. of Burgos) as a station for *L. pomponium*. Further allusion to the Burgos plant is made under *L. pyrenaicum rubrum*.)

SPECIMENS EXAMINED: 8 fresh.

BULB. Globose-ovoid; 2 $\frac{1}{2}$ " in vertical and horizontal diameters, yellow slightly on exposure. Scales ovate, ovate-lanceolate or oblanceolate, acute or subacute.

STEM. 12"-36" high, green, spotted purple on lower part, slightly ridged, smooth, naked for 2"-4" below raceme.

* Dominique Villars appears to have been the first to publish (in part) the true distribution. [Hist. Pl. Dauph., II, 276 (1787)].



FIG. 21.—*L. POMPONIUM*.
Flowers and foliage stem \times about $\frac{3}{4}$.
Capsule $\times \frac{3}{4}$.
a = Portion of leaf to show absence of cilia on lower surface ;
semi-diagrammatic.

LEAVES. Very numerous; spreading below, then ascending-spreading and, towards top of stem, ascending; linear, tapering gradually to a sharp point, channelled and keeled, slightly curved on the flat and sometimes twisted through a quarter turn; from 5" long by 3" broad below to 24" long by $\frac{1}{16}$ " broad (or less) above; usually, but not invariably, the ciliation at the margin is dense enough to produce a silvery edge; both surfaces thickly speckled with punctate glands giving a grey appearance; veins 3, nude.

INFLORESCENCE. 1-6 or more flowers. *Peduncles* up to 5" long, green speckled purple, curved downwards towards flowers, bracteolate.

FLOWERS. Open middle of June; characteristic smell; recurved for over three-quarters of length; about 2" across; vermillion within and speckled with raised purple spots and lines in lower half or two-thirds (except for lowest half-inch or so); outer surface orange-red stained purple-green at base. *Perianth segments* 2"-2 $\frac{1}{2}$ " long, $\frac{1}{2}$ "-3" wide; the outer ovate-lanceolate, acute and a little broader than the inner; the inner lanceolate, acute, keeled, slightly callous at tips, bearing pedunculated warts in relation to outer ends of nectariferous furrows; *nectariferous furrows* green-stained, narrowly triangular. *Anthers* $\frac{1}{2}$ "- $\frac{3}{4}$ " long. *Filaments* pale green, smooth, 1"-1 $\frac{1}{2}$ " long. *Style* rounded below, triangular above, slightly curved, together with *stigma* $\frac{3}{4}$ " long (+ or -). *Ovary* $\frac{1}{2}$ " long (+ or -).

CAPSELLE. Broadly ovoid or goblet-shaped, apex depressed, 6-angled, angles slightly winged; up to 1 $\frac{1}{2}$ " long and $\frac{7}{8}$ " broad.

L. PYRENAICUM Gouan, *Illust. & Obs. Bot.*, 25 (1773). (Fig. 22).

Synonyms: *L. pomponium* Linn., *Sp. Pl.* ed. i. 302 (1753) in part.

L. pomponium var. α Ker-Gawl., *Bot. Mag.* sub t. 708 (1805).

L. flavum Lam. & DC., *Fl. Franc.*, 3, 203 (1805).

L. chalcedonicum var. β Gmel. ex Kunth, *Enum. Pl.*, 4, 262 (1843).

L. albanicum Schur, *Enum. pl. Transsilv.*, 662 (1866). (This is given as a synonym by Elwes, *Genus Lil.* sub t. 47 (1880). Modern botanists would refer it to *L. carniolicum* ssp. *fankae*.

DISTRIBUTION: Spain: Asturias and Santander (Cantabrian Mts.) Catalonia (Montes de Nuria).

Pyrenees: From Eaux-Bonnes to Mt. Louis.

France: Montagne Noire, Forêt de Ramonden (Dept. of Tarn).

(Extracted from the works of PHILIPPI, WILLKOMM & LANGE and GRENIER & GODRON.)

SPECIMENS EXAMINED: 6 fresh.

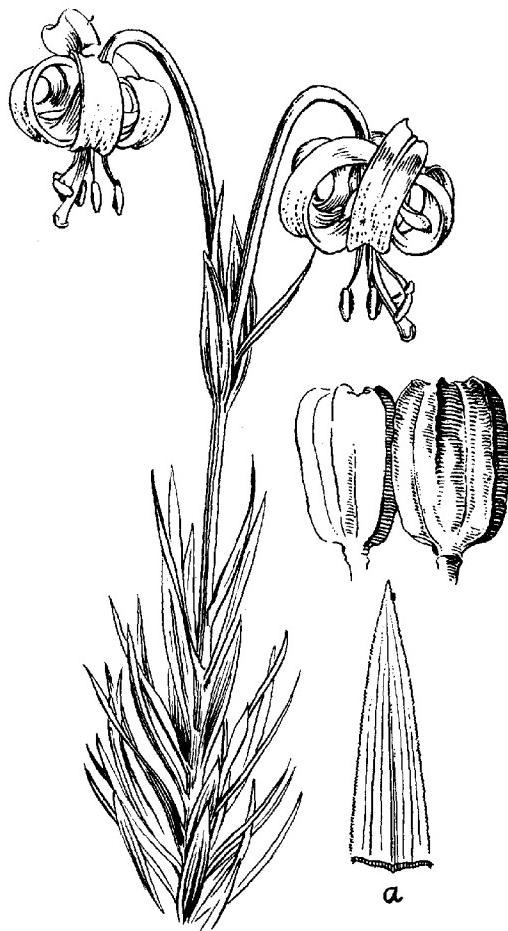
BULB. Globose-ovoid; about 2 $\frac{1}{2}$ " in vertical and horizontal diameters. Scales ovate, ovate-lanceolate, acute; pale heliotrope on exposure.

STEM. 12"-36" high; green, occasionally spotted purple above and sometimes heavily suffused purple below; smooth.

LEAVES. Very numerous; ascending-spreading in lower third of stem, spreading above; linear-lanceolate tapering to a sharp or blunt apex; 3"-5" long by 1"-3" wide below, gradually diminishing in size upwards to 1" long by $\frac{1}{8}$ " wide. Veins 5-7, nude. May be silvery-edged.

INFLORESCENCE. 1-8 or more flowers; *peduncles* 2"-5" long, green, sometimes purple-spotted, smooth, bent outwards or downwards towards flower; bracteolate.

FLOWERS. Open in early June; characteristic smell with a hint of sweetness added; a mawkish odour. Recurved for over three-quarters of length; about 1 $\frac{1}{2}$ " across; greenish-yellow gradually changing to the pale green

FIG. 22.—*L. PYRENAICUM*.

Flowers, capsules and foliage stem \times about $\frac{1}{2}$.

a = Portion of leaf to show absence of cilia on lower surface ; semi-diagrammatic.

of lower third ; middle third speckled with dark purple, raised spots and lines within ; in the inner segments these become wart-like and pedunculated in relation to outer ends of nectariferous furrows. *Nectariferous furrows* comparatively deep, lower third stained purple. *Outer perianth segments* $\frac{1}{2}$ " long, $\frac{3}{8}$ " wide, oblanceolate, acute, apex callous and forward-pointing ; *inner segments* $\frac{1}{2}$ " long, $\frac{1}{2}$ " wide, lanceolate, subacute or blunt, keeled. *Anthers* $\frac{1}{8}$ " long. *Filaments* $1\frac{1}{2}$ "- $1\frac{3}{16}$ " long, pale green, smooth. *Style* triangular, together with *stigma* $\frac{1}{8}$ " long (+ or —). *Ovary* $\frac{3}{8}$ " long.

CAPSULE. 6-sided barrel-shaped or obconic with buttressed angles, apex depressed, up to $1\frac{1}{2}$ " long and 1" in diameter.

L. pyrenaicum f. rubrum Hort.

When the distribution of *L. pomponium* was discussed (see above), reference was made to a "*L. pomponium*" mentioned by Palau and more recently by Blas Lazaro e Ibiza as inhabiting the mountains of Burgos.

In the first place, it is extremely unlikely that such an otherwise compactly distributed Lily as *L. pomponium* should take a jump, so to speak, to the Pyrenees. In the second, the name *L. pomponium* did not bear the hard and fast meaning in Palau's time (later 18th century) that it does to-day (see synonymy). In the third, Lazaro e Ibiza's description of the Burgos "*L. pomponium*" applies more closely to *L. pyrenaicum rubrum* than it does to *L. pomponium*. The flowers, for example, are stated to be red or orange-coloured. The evidence points, in short, to Palau's plant being the red form of *L. pyrenaicum*.

ELWES (Genus *Lilium*, footnote, sub t. 46 (1880)) appears inclined to this view, but on the next page writes "the dull-red variety of *L. pyrenaicum* . . . is of doubtful origin . . . It may be descended from the real *pomponium* and changed by long cultivation." As the cultivation of *L. pomponium* has only been continued by the constant importation of wild bulbs, this speculation has little to support it. Moreover, it is difficult to think that even a thousand years of cultivation could convert *L. pomponium* into a facsimile of *L. pyrenaicum*, a facsimile, that is, in all but colour.

It has also been suggested that its silver-margined leaves point to *L. pyrenaicum rubrum* being a hybrid, presumably of garden origin, between the type and *L. pomponium*, the latter parent being considered responsible for the attribute. As, however, silver-edged foliage is not an invariable possession of either *L. pomponium* or *L. pyrenaicum rubrum*, and as it often occurs in a modified degree in *L. pyrenaicum* itself, one cannot credit this occasional feature as indicative of *pomponium* influence, particularly as there is no other diagnostic of *pomponium* ancestry.

From what we know of the plant and on what we may fairly surmise, it may be reasonably considered simply a colour form of the type, and its name given a standing it has not hitherto enjoyed by describing the Lily thus :

L. PYRENAICUM forma RUBRUM : forma L. PYRENAICI a qua floribus rubris differt.

And that difference, a red instead of a greenish-yellow ground colour in the flower, is the only fixed one between type and form.

A brief scrutiny of the characters of the Lilies described will suggest that KÓSANIN's method of using ciliated veins as a means of distinguishing those most closely allied to *L. carniolicum* itself may, with some broadening, be made a basis for classification of the whole Carniolicum group; thus:

1. Lower surface of leaf exhibits glandular cilia on veins.
 - A. Leaves show no abrupt change in size and arrangement:
 - a. Ciliation marked and regular; flowers red or orange *L. carniolicum*
 - b. Ciliation less marked, but regular; flowers yellow *L. carniolicum* ssp. *Jankae*
 - c. Ciliation less obvious still and patchy *L. carniolicum* f. *bosniacum*
 - B. Leaves show abrupt transition in size and arrangement between lower and upper series:
 - a. Upper leaves tend towards the ovate; peduncles usually bracteolate; style trilobed in transverse section *L. chalcedonicum*
 - b. Upper leaves lanceolate; peduncles usually non-bracteolate; style almost triangular in transverse section *L. Heldreichii*
2. Lower surface of leaf exhibits nude veins.
 - A. Leaves very numerous:
 - a. Leaves linear, channelled and keeled *L. pomponium*
 - b. Leaves linear-lanceolate, not channelled or keeled *L. pyrenaicum*
 - B. Leaves 30-50, lanceolate, ovate or oblong *L. carniolicum* ssp. *albanicum*

The same means of differentiation is also of assistance in composing a graphic rendering of the relationships of the members of the Carniolicum group.

The pleasant duty remains to thank those who have given me invaluable assistance in preparing this article. I particularly wish to say how grateful I am to Mr. H. A. THOMERSON for his beautiful and accurate drawings, and to thank him for his attention to the demands of a frequently exacting client. Dr. LEMPERG of Hatzendorf has spared neither time nor trouble in sending me fresh bulbs, observations of his own and extracts from the writings of others. Mr. CONSTABLE's generosity in the matter of fresh material from his enormous collection has been unexampled. To Kew, in the persons of Mr. A. D. COTTON and Dr. W. B. TURRILL, I am deeply indebted for the loan of dried specimens and the gift of fresh. To Prof. Grušić of the

University of Belgrade, who lent me a great amount of dry material, I am most grateful, and also to my friend Mr. P. ROSENHEIM for translations from the German. Mr. F. J. CHITTENDEN, Mr. R. L. HARROW, Mr. A. SIMMONDS and Mr. W. T. STEARN, all of the staff of the Royal Horticultural Society, have given help which, it is no exaggeration to say, is beyond repayment.

SEED PATTERNS AND INCOMPATIBILITIES IN LILIUM
CANDIDUM.

By A. B. STOUT and W. M. PORTERFIELD, The New York Botanical Garden.

THE SEED PATTERNS.

THIS paper is the first to present data on seed patterns obtained from controlled pollinations in Lilies with reference to (a) the scope of incompatibilities in reduced seeding, and (b) the phenomena of stimulative phenospermy.

The broad, flattened, and rather large seeds in the capsules of Lilies lie in two compacted vertical rows in each of the three locules. At the time when a capsule is fully mature and about to dehisce the seeds in each row may be removed in the order of their position and the character of each determined and recorded. The seeds themselves may be arranged and photographed to show what may be called a *seed pattern*, or the data for the seeds in one or more rows of a capsule may be presented by the use of symbols in a *seed pattern chart*.

These seed patterns and seed pattern charts (see figures 2, 3, 4, 5, 7 and 8) show the relative numbers of seeds for the different classes contained in individual capsules and the distributions of each class. A comparison of the seed patterns resulting from different grades of self-compatibility and cross-compatibility readily reveals certain conditions important to the analysis of the (a) scope and action of incompatibilities in fertilization and (b) inherent abortions that may be present in ovules.

Accurate and complete seed patterns for capsules of *Lilium* are possible when the capsules are of good size and fairly well developed even though there is reduced seeding which involves both partial compatibility (either self- or cross-) and reduction in ovule development. The evidence indicates that in many such cases all the ovules

EXPLANATION OF FIGURE 23.

Seeds of *L. candidum* var. *salonikae* showing various conditions of development from normal to smallest phenospermic seeds.

A, normal class-1 seed with fully developed embryo and endosperm. *B*, hemispermic class-2 seed showing large misplaced embryo and reduced endosperm. *C*, hemispermic seed showing reduction in both embryo and endosperm. *D*, hemispermic class-3 seed having endosperm and greatly reduced embryo. *E*, class-3 seed with abundant endosperm, but no embryo (an endospermic seed). *F*, phenospermic class-4 seed of normal size, but without embryo or endosperm. *G*, phenospermic seed of class-5 showing reduction in size. *H*, phenospermic seed of class-6 showing small size. Magnification 4 \times .

At *I*, is shown a phenospermic class-5 seed with the outer integument dissected away to show the empty shrivelled nucellar sac. Magnification 9 \times .

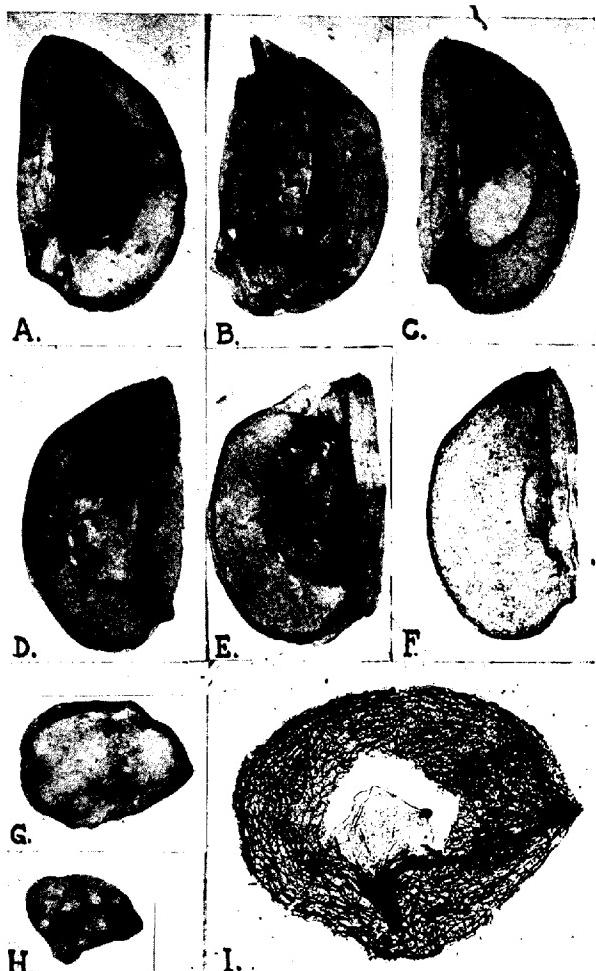


FIG. 23.—SEEDS OF *LILIUM CANDIDUM SALONIKAE*.

[For references see p. 108.]

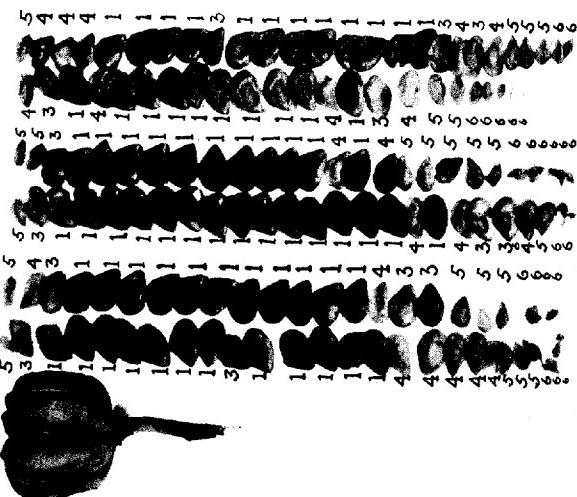


FIG. 24.—SEED PATTERNS.

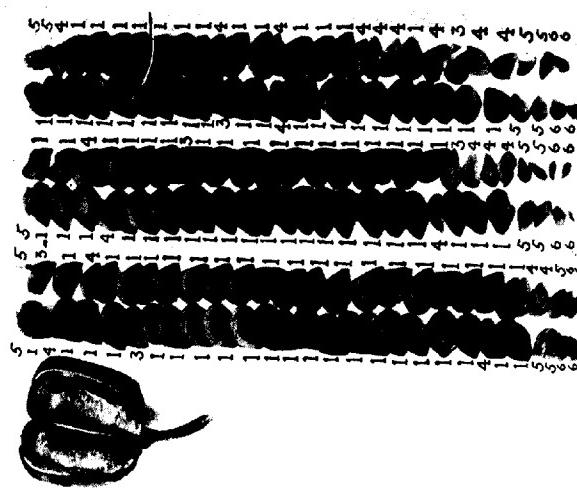


FIG. 25.—SEED PATTERNS.

1 to face p. 109.

develop to such a size that they may be counted and evaluated in the ripe capsules as normal seeds, hemispermic seeds, and phenospermic seeds. In the extremes of reduced seedling with a decidedly distal distribution of few normal seeds the basal portion of a capsule may be undeveloped and its ovules scarcely enlarged (see figure 31).

THE CLASSES OF SEEDS (see figure 23). Class 1. The normal or good seeds are all of full size with a completely developed embryo lying in the mid-region of the endosperm. Figure 23, A illustrates a typical normal seed of *L. candidum* var. *salonikae* enlarged four times. The endosperm occupies about one half the area of the seed and the embryo is shown in position extending from the micropylar end of the endosperm through the central region to the antipodal end.

Classes 2 and 3. The term *hemispermic* is here used for those imperfectly developed seeds in which either embryo or endosperm is lacking or reduced in size. In some seeds both endosperm and embryo are reduced in development. A seed which has an embryo, but little or no endosperm (class 2) may be referred to as *genospermic*. Often the embryo is well developed in size, but it is frequently out of its normal position and the scanty endosperm when present is of irregular and asymmetrical proportions (figure 23, B). A seed that has endosperm but no embryo may be called *endospermic* (fig. 23, E). In this class the endosperm may be very fully developed, but the embryo is lacking or reduced to a small body. In respect to the development of the seed integument the hemispermic seeds are usually as large as normal seeds.

Figure 23, B, C and D illustrate several intergrades between normal and purely endospermic seeds. In B the embryo is of normal length, but it is lateral in position and the endosperm is somewhat reduced. C shows a seed of normal size, but with reduced embryo and a small amount of endosperm located only in the anterior half of the nucellar sac. D shows further reduction in the embryo with the endosperm much reduced in volume. E shows an example of a hemispermic seed without an embryo, but with endosperm fully developed.

Classes 4, 5 and 6. The phenospermic* seeds consist chiefly of the enlarged outer integument within which there is an aborted sac, or

* The term "phenospermic" was suggested by GOODSPED (1915) for abortive seeds in *Nicotiana Tabacum* Cuba, which appear to be normal, but consist only of empty seed-coats.

EXPLANATION OF FIGURES 24 AND 25.

Here are shown two capsules of nearly equal size and their seeds arranged in patterns ($\times \frac{3}{2}$). These are from flowers at the same level on the same plant (34-15, No. 3). Figure 24 (on the left) was obtained by self-pollination and figure 25 (on the right) was from a highly compatible cross-pollination. The numbers of ovules were 152 and 167 respectively. The percentages of normal seeds were 46.7 and 67.0. The number of normal seeds was greater in each row in the crossed capsule, being 21, 19, 21, 17, 21 and 13 in comparison to 12, 11, 15, 11, 10 and 12. The proportion of phenospermic seeds (classes 4, 5 and 6) was greater in the base of the selfed capsule. The difference in the number of normal seeds here shown is an expression of different degrees of compatibility and is very constant for such relations.

"nucellar sac," composed of inner integument and nucellus. They may be classed as 4, 5 and 6 according to relative size. It is believed that most, if not all, of the phenospermic seeds develop from ovules that are not fertilized, but are *stimulated* to further development. In these seeds there is no trace of embryo or endosperm. In a Class 6 seed measuring 6 x 3 mm. the nucellar sac is often only 0.8mm. in length (figure 23, I).

A typical large-sized phenospermic seed is shown in figure 23, F. There is no reduction in size, but there is no trace of either embryo or endosperm. The integument has grown to full size. The faint outlines of the nucellar sac can be seen in the photograph. Figure 23, G, is a smaller phenospermic seed and H is a still smaller one, representing respectively classes 5 and 6.

The determination of the classes of seeds here designated for Lilies is not difficult. By holding a seed before a strong light one can readily determine its condition. Doubtful cases can be examined with a dissecting microscope either with the seed dry or soaked for a time in water, in which case the softened seeds may be dissected for a most accurate examination. Phenospermic seeds are empty, thin and translucent in the mid-region where the endosperm and embryo are lacking.

STERILITIES IN *LILIUM CANDIDUM* VAR. *SALONIKAE*.

Studies of 12 Seedlings of Unknown Parentage.

Twelve well-developed individuals of the *salonikae* variety of *L. candidum*, grown from seed obtained from England, were selected for special pollinations.* For each of five plants the entire flower cluster was enclosed in a paper bag and as the flowers opened they were self- and close-pollinated by hand. The flowers of the seven other plants were cross-pollinated, but not bagged and the pollen used was obtained at random. The capsules were collected when ripe and counts were made of the good seeds and the poorly developed seeds in each.

FOR THE SELF-POLLINATIONS capsules of good size were obtained on four plants, but there were also some pear-shaped capsules, and three ovaries failed to develop into capsules. Another plant had but two flowers of which one failed to develop and one produced a small poor capsule. The seeds judged to be good, in the fourteen capsules obtained, ranges from 2 to 64, the average was 26 in a capsule; the number of poor seeds present ranged from 79 to 148. The average for all ovules in a capsule, as judged by the seeds of all types, was 139.

According to the results one plant was almost fully self-incompatible; one was feebly self-compatible, for its four selfed capsules were somewhat pear-shaped and the number of good seeds ranged from

* These plants were grown at the Boyce Thompson Institute for Plant Research in connexion with a Lily Disease Scholarship, and the pollinations were made by Dr. KEITH O'LEARY in 1934.

2 to 11; one plant gave from 15 to 56 good seeds in 5 selfed capsules of good size; and another gave 11, 51 and 64 good seeds for three capsules.

FOR THE CROSS-POLLINATIONS twenty-six capsules were obtained, and of the flowers pollinated only two pistils failed to develop into capsules. All four of the capsules on one plant were reduced in size, somewhat wrinkled and pear-shaped, and they contained only from 1 to 18 good seeds. Possibly this plant was abnormal in some condition of growth. For the other plants the capsules were large and well-formed and the good seeds in a capsule ranged from 11 to 115, and the poor ones from 50 to 135. The average for all seeds and rudiments of seeds in these capsules was 149.

COMPARISON OF RESULTS. The total number of all ovules in an ovary as judged by the counts of seeds was nearly the same for all the different plants studied except when the smallest of the selfed capsules were included in which many ovules were too small to be counted accurately.

For the selfed capsules the number of good seeds in a capsule reached a maximum of 64 and the average was 19 per cent. of the ovules. For the good seed in the crossed capsules the maximum was 119, the average was 56, and the average percentage was 37.

In no capsule on any plant did more than 70 per cent. of the ovules develop into what were classed as good seeds. The number or the proportion of good seeds in capsules was not related to the total number of ovules that was present in capsules, a situation characteristic of the selective fertilizations of incompatibility.

Certain cross-pollinations resulted in large and better developed capsules and in more good seed in a capsule than did any self-pollination. For further and more exact studies a progeny was grown from the seed of one of these capsules.

STUDIES OF A PROGENY GROWN FROM THE SEEDS OF A SINGLE SEED PARENT.

From the 91 seeds in a single capsule which were obtained by cross-pollination from one of the plants discussed above, 84 vigorous young plants were obtained. These were grown under the series number 34-15. Later, in transplanting these plants there was much mortality due to infection of bulb-rot fungi. During 1936 and 1937 a total of 20 of these plants produced flowers which were utilized for self- and cross-pollinations under control by bagging and also emasculation for all cross-pollinations.*

THE SELF-POLLINATIONS. Thirteen plants were completely self-incompatible. For them the ovaries of all flowers which were self- or close-pollinated did not begin to enlarge.

Four plants were classed as feebly self-compatible. At least some of their self-pollinated pistils developed into capsules, but the best of

* In 1936 the pollinations were made by Mr. J. R. SHUMAN, and in 1937 they were made by Dr. W. M. PORTERFIELD.

these were poorly developed, often pear-shaped, and the number of normal seeds in a capsule was not larger than 40 (Table I. Nos. 5, 11, 16 and 17; upper chart in figure 26; and figure 30).

Three plants were classed as the most highly self-compatible. One flower of each of these was selfed, and the numbers of normal seeds were as follows: 59 seeds, a percentage of 31; 71 seeds, 46.7 per cent. (see figure 24); and 70 seeds, 38 per cent. The highest percentage of ovules which produced normal seeds in these most highly self-compatible plants was less than 50 (Table I; Nos. 3, 10 and 23).

THE CROSS-POLLINATIONS which were made with these plants involved 31 different combinations of which there were only three reciprocals. The low number of flowers produced by a plant greatly limited the number of different pollinations that could be made, and hence relatively few of the possible combinations were tested.

TABLE I.—Data typical for classes and numbers of seeds in selfed and crossed capsules of plants of *Lilium candidum*.

<i>L. candidum</i> var. <i>salonicum</i> . Series 34-15.	Normal.		Hemispermic.		Phenospermic.			Total.
	1	percent.	2	3	4	5	6	
No. 3 selfed	71	46	0	14	21	23	23	152
5 "	30	17	0	0	62	29	47	168
10 "	50	31	0	4	69	28	26	180
11 "	40	24	0	18	32	30	43	163
16 "	21	13	0	15	52	42	31	162
17 "	23	12	0	0	105	28	23	179
23 "	70	38	0	0	56	37	19	182
I X 3	85	46	0	1	24	29	37	176
I X 10	71	40	0	4	37	38	29	179
3 X 5	111	65	2	0	21	18	17	160
3 X 9	112	67	0	6	21	16	12	167
4 X 1	2	1	0	3	84	86	15	190
7 X 4	18	12	0	1	55	42	31	147
7 X 5	85	57	0	7	36	14	7	149
11 X 12	84	51	0	18	31	15	14	162
12 X 10	33	20	2	5	59	33	30	162
17 X 18	34	21	0	10	108	7	7	166
18 X 17	131	78	1	1	22	12	0	167
19 X 22	49	21	4	12	74	28	11	178
19 X 18	92	50	0	2	52	22	7	181
21 X 17	61	35	1	24	63	21	2	172
24 X 10	13	8	0	0	79	31	34	157
<i>L. candidum</i> (Geneva) X <i>L. candidum</i> var. <i>salonicum</i> (34-15).								
Capsule 1	160	66	0	2	30	16	31	239
" 2	154	62	5	5	42	22	18	246
" 3	152	63	0	5	35	15	31	238
" 4	132	66	1	2	25	22	17	199
" 5	138	65	1	5	34	18	16	212
" 6	131	65	0	3	24	21	20	199

EXPLANATION OF FIGURES 26 AND 27.

Figure 26 shows characteristic distal distribution of normal seed (above) with reduced seeding in feeble self-fertility; and (below) with much greater compatibility in a cross-relation. Both capsules are from one plant (34-15 No. 11). The zonal distribution of phenospermic seeds according to size suggest stimulation from fertilized ovules above.

Figure 27. Two seed patterns which show differences in reciprocal relations. The upper chart shows a very complete cross-compatibility. The lower chart shows reduced seeding with a general scattered distribution of good seeds.

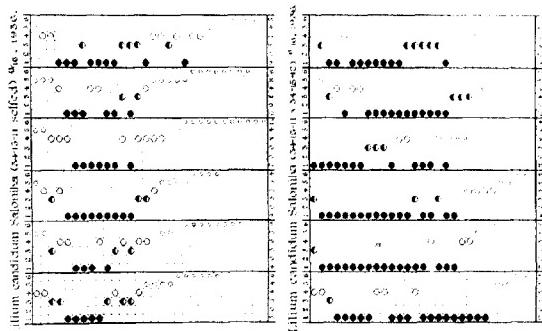


FIG. 26. STEP PATTERNS.

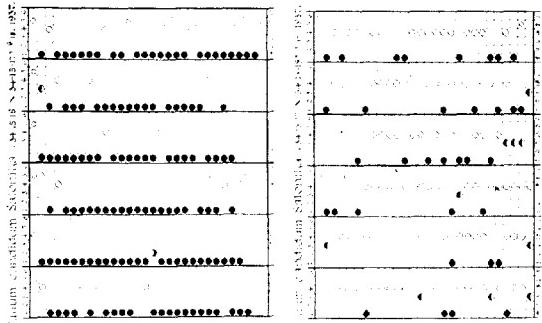


FIG. 27. STEP PATTERNS.
Dots, $\sigma_0 = \sigma_1$.

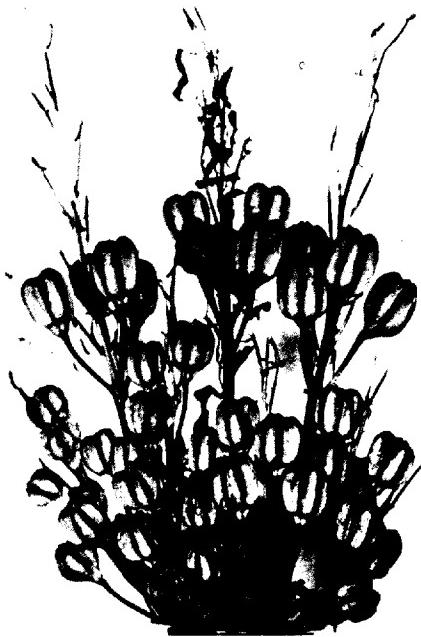


FIG. 28.—CAPSULES OF *L. CANDIDUM*.

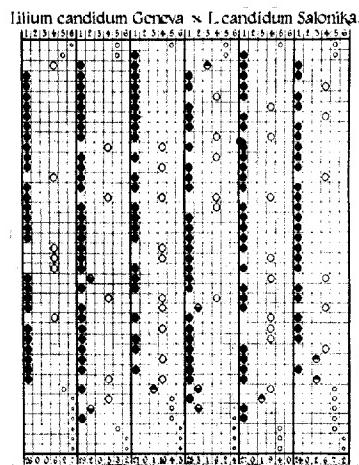


FIG. 29.—SEED PATTERN FROM A CAPSULE SHOWN IN FIG. 28.

There were three cross-relations that were completely 0. There were ten cross-relations that may be classed as feebly cross-compatible. For these no capsule produced more than 50 seeds or a percentage greater than 21 (see lower chart in figure 27).

There were eighteen cross-relations that were judged to be highly cross-compatible. For these the number of normal seeds ranged from 48 to 131 and the percentages for these ranged from 31 to 78 (see figure 25, lower chart of figure 26 and upper chart of figure 27).

THE EVALUATION OF PHENOSPERMIC SEEDS IN THESE CAPSULES.

The highest percentage of ovules which produced seed in any capsule was 78 (upper chart in figure 27). In the other large well-formed capsules obtained from cross-pollination the percentages ranged from 31 to 67. The numbers of entirely empty or phenospermic seeds (of the class 4, 5 and 6) were rather high even in many of the capsules obtained by cross-pollination. This condition raises the question as to whether the ovules which develop into phenospermic seeds are capable of functioning in any fertilization.

On this matter it is evident that the number of phenospermic seeds is greater in the most highly self-compatible capsules than in sister capsules on the same plant obtained from relations most highly cross-compatible. In selfing, therefore, at least some ovules which are able to function in other relations are not functioning. In the *reduced seeding* of the selfings the number of seeds is less than that which is possible (compare figures 24 and 25 and the charts of figure 25).

In the studies made thus far, nevertheless, there were some phenospermic seeds in the best seed patterns of the most fully compatible cross-pollinations. The seed patterns show that it is the rule that some phenospermic seeds are located in the extreme basal portion of capsules. Possibly some of these are inherently aborted. But the number and extent of the basal phenospermic seeds in ripe capsules increases with partial compatibility, both self- and for certain of the cross-relations, until pear-shaped capsules are produced, in which cases many ovules that are able to function are not fertilized. In such cases the partial compatibility discriminates against the ovules in the lower part of the ovule (see especially upper chart in figure 26). But phenospermic seeds are also often distributed somewhat at random in the central and upper portions of the capsule in a manner that indicates that pollen tubes do pass by certain ovules and fertilize those

EXPLANATION OF FIGURES 28 AND 29.

Figure 28. Members of an old cultivated clone of *Lilium candidum* which are being grown about Geneva, N.Y. are self- and close-incompatible as shown here by the undeveloped ovaries; but they produce fine capsules when there are compatible cross-pollinations from plants of the Salomika variety.

Figure 29. A seed pattern typical for one of the capsules shown in figure 28. The total number of good seeds is 154 or 62 per cent of all ovules. The phenospermic seeds of smallest size are grouped at the extremes of the apex and the base.

at lower levels (see especially lower chart in figure 27). In the highest seed production observed in any relation ($34\text{-}15/18 \times 17$) 131 good seeds developed (a percentage of 78), and in this case 34 ovules were not fertilized.

SUMMARY AND COMPARISON OF RESULTS. The results of experimental self- and cross-pollinations in this group of seedlings, derived from two parents only, clearly indicate that :—

1. All completely self-incompatible individuals were able to produce fine capsules and many viable seeds to those cross-pollinations which were highly compatible.
2. The partially self-compatible plants produced larger capsules with higher numbers of normal seeds in certain compatible cross-relations.
3. The most highly self-compatible plants were still more productive of normal seed when they were crossed in most highly compatible relations.
4. Plants which were *completely* self-incompatible were either entirely cross-incompatible, partially cross-compatible, or highly cross-compatible with each other.
5. In this group of sister seedlings there were both (a) self-incompatibility and self-compatibility and (b) cross-incompatibility and cross-compatibility and there were various grades of each.
6. These studies do not determine whether the incompatibility reactions in plants of *L. candidum* are determined by haploid nuclear constitution of pollen tubes or by immediate sporophytic origin; or the extent to which selective elimination of genotypic classes in progenies may occur. To determine definitely the type of incompatibility, as simple personate, the *Capsella*-type, or an associate type (see Stout, 1938), more extensive tests of progenies are necessary.

THE SELF-INCOMPATIBILITY OF THE OLD CULTIVATED CLONE OR CLONES.

THE EARLIER STUDIES of the senior author on incompatibility in an old cultivated clone or possibly in different cultivated clones of *L. candidum* have already been reported (Stout 1931, 1933). The results may be summarized as follows :—

1. All plants grown were either completely self-incompatible or they rarely produced some small, poorly developed, pear-shaped capsules which contained few seeds as shown in figure 31.
2. Almost always a high percentage of pollen of these plants germinated well in artificial culture.
3. Pollen applied to pistils of the same plant germinated and grew rapidly into the pistil for a period of 4 to 8 hours after which only a slight advance was made (see Stout, 1933).
4. During this period of study pollinations between different individuals gave the same results as did the selfings.

The conclusion was that at any one time there were being studied only plants of one clone known to be slightly or rarely self-fruitful (Stout, 1933).

SEVERAL YEARS LATER a considerable number of plants of *L. candidum* were assembled from various sources and grown in a plot for the study of the Botrytis disease.* There was noticeable variation in these plants, especially in the colour of the stems. Some cross-pollinations were made between these plants and large well-filled capsules were obtained from some of the flowers. There was no opportunity to make further tests, but it seems that at least two clones were present, and that there was cross-compatibility between different clones. At any rate it was demonstrated that at least some of the plants were able to produce large capsules with numerous seeds when there were pollinations.

THE GENEVA CLONE OF LILUM CANDIDUM.

In various flower gardens in and about Geneva, N.Y., there are growing clusters of fine plants of what appears to be a single clone of *L. candidum*. It is our belief that these plants do not produce capsules and seed to self-, close-, or intra-pollinations except occasionally when small imperfect pear-shaped capsules may develop, such as those shown in figure 31.

In 1937 some of the flowers on various of these plants were pollinated by Mr. GEORGE SLATE with pollen from seedlings of the *salonikae* variety which were grown by him from some of the seeds reported in this paper.

The pistils of the flowers thus cross-pollinated developed into the large capsules shown in figure 28.

The seeds in six of these capsules were evaluated and counted. The total number of all classes of seeds ranged from 199 to 239; the range for normal seeds was 131 to 160; and the percentages for normal seeds ranged from 62 to 66 (see table 1). A seed-pattern chart for a typical capsule is shown in figure 29.

In comparison with the seedling plants of the *salonikae* variety already discussed it is to be noted that, (a) these capsules were larger, (b) they contained more seeds, (c) the average for normal seeds was greater, and (d) the seeds were somewhat larger. The larger size of capsules and seeds and the greater number of ovules in a capsule are presumably inherent characteristics. These plants of a clone long cultivated and propagated vegetatively bear flowers which do not produce capsules to self-pollination, to close-pollination, or to intra-clonal pollination. Yet the pollen is highly viable, and when there is

* Lily Disease Investigation Fellowship, established through the cooperation of the Horticultural Society of New York, The Boyce Thompson Institute of Plant Research, Cornell University and the New York Botanical Garden. These particular pollinations were made by Dr. C. F. GUTERMAN merely for the purpose of obtaining seeds.

compatible cross-pollination with plants of the *salonikae* variety the pistils and ovules are able to function very fully.

LILIUM CANDIDUM, OLD GARDEN CLONE X L. LONGIFLORUM.

A report (STOUT, 1933) has already been published that of 40 flowers of an old garden clone of *L. candidum*, which were emasculated in the bud and pollinated under control with pollen of *L. longiflorum*, two developed into pear-shaped capsules which contained a few seeds. GRIFFITHS (1925) has stated that such cross-pollination "commonly gives a set of seed which produces true *L. candidum* as though its own pollen were used." Such results suggest induced apomixis or merogamy. But whether there was apomixis or hybridization in this instance relatively few ovules formed normal seeds in the only two capsules obtained.

REDUCED SEEDING IN THE PARTIAL SELECTIVE ACTION OF INCOMPATIBILITIES.

The results reported in this paper repeatedly indicate that in many relations in fertilization, both self- and cross-, there is the reduced seeding which is a condition characteristic of certain relations in the incompatibilities of numerous species and groups of horticultural plants (STOUT, 1938). There is proper and ample pollination, yet many ovules which are able to function are not fertilized while others in the same ovary are fertilized. In respect to the size and the development of the capsule and to the reduction in the number of normal seeds such a relation is one of incomplete or partial compatibility. The seed patterns for capsules which show reduced seeding reveal various aspects of pollen-tube behaviour in respect to the fertilizations which occur. There are two rather distinctly different types of seed patterns with respect to the distribution of normal seeds. The normal seeds may be concentrated in the upper or distal portion of the capsule as shown in the upper chart of figure 26, which we may term *distal distribution*, or there may be a sparse and scattered distribution throughout both proximal and distal portions of the capsule as shown in the lower chart of figure 27, which we may term *scattered distribution*.

In a distal distribution of seeds (as in upper chart of figure 26) the compatible reactions in fertilization are decidedly limited to the upper portion of the ovary which is nearest to the style and to the source of the pollen tubes. But it seems certain that the number of pollen tubes which reach the ovary is relatively small and that these extend only as far as good seeds are obtained. There appears to be a reaction between pollen tubes and the pistil and its ovary which results in this

EXPLANATION OF FIGURE 30.

Four of the six rows of seeds in a capsule of plant 34-15 No. 17 showing much reduced seeding to self-pollination. The normal seeds are few and they are more central than distal in location. The size of the phenospermic seeds diminishes according to distance above or below the normal seeds.

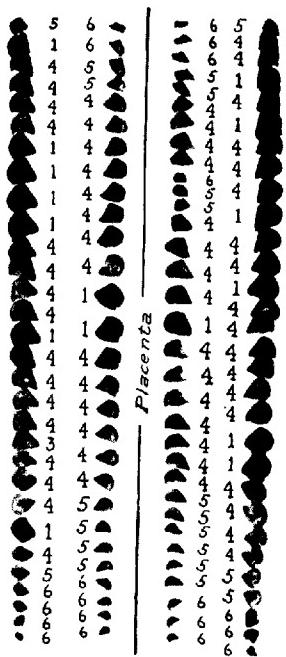
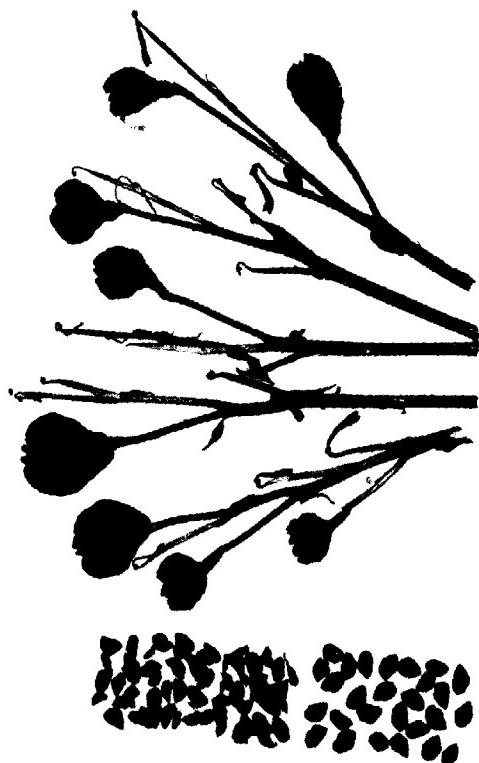


FIG. 30.—SEED PATTERNS.
(p. 116.)

FIG. 34.—SEEDS AND CAPSULES OF *L. CANDIDA*.



limitation in the number of fertilizations. Yet there is scant evidence that the pollen tubes exercise direct selective action with the ovules.

In a scattered distribution of normal seeds, as shown in the lower chart of figure 26, at least some pollen tubes penetrated to the base of the ovary and in doing this they passed by many ovules. Whether the pollen tubes were few or many in number the scattered fertilizations indicate direct selective relations with the ovules. If there are numerous pollen tubes certain of these may enter ovules that are not fertilized.

It is our conclusion that these two types of patterns in reduced seeding involve two quite different incompatibility reactions. In the distal fertilizations there is a limitation in the number of pollen tubes which reach the ovary and their penetration is restricted to the upper part of the ovary. In the general scattered distribution there is a limitation through the selective reactions between ovules and pollen tubes.

STIMULATIVE PHENOSPERMY.

There is no doubt that in reduced seeding in Lilies the phenospermic seeds develop as they do in response to stimulation. In the ovary at the time of anthesis the ovules are all of minute size. If there is no pollination or a fully incompatible pollination the ovary shows no vegetative parthenocarpy and the ovules show no phenospermy. But when a relatively few of the ovules are fertilized a capsule of good size may develop and the unfertilized ovules may develop to the sizes shown in figures 23, F, G, and H. It may be assumed that the phenospermic seeds develop as they do in response to one or more of the following influences:—(a) A direct influence from pollen tubes independent of fertilization, (b) a special influence that arises in and spreads from ovules, either at the time of fertilization or during the development into normal seeds, or (c) as an effect of food materials that are flowing into the ovary. Evidence in this point is to be had in the distribution of the different sizes of phenospermic seeds in relation to that of the normal seeds.

A STUDY OF THE DISTRIBUTION OF PHENOSPERMIC SEEDS according to their sizes shows (a) that a phenospermic seed which is located between or adjacent to normal seeds is generally of large size (class 4), (b) that seeds of the next smaller size (class 5) are as a rule located further from the normal seeds, and (c) that the smallest phenospermic

EXPLANATION OF FIGURE 31.

The capsules shown here were obtained on plants of an old cultivated clone of *Lilium candidum* after self-pollination. The stems were left attached to the bulbs and there were self- and close-pollinations of all flowers without any treatment of stigmas. This illustrates the partial and fluctuating self-compatibility which regularly occurs in a few ovaries in the old cultivated clones of this species when a large number of flowers are self- and close-pollinated. There are only a few good seeds which are decidedly distal in location. The extreme basal portion of the pear-shaped capsules contain only class-6 phenospermic seeds or ovules which are still smaller or which may not have enlarged.

seeds (class 6) are still further removed from a fertilized ovule (see figures 26 and 30).

In the distal distribution of good seeds shown in the upper chart of figure 26, in each of the rows the lower phenospermic seeds show most decidedly a zonal gradation in size. The lower ones which are farthest from the normal seeds are of the smallest sizes. When the distribution of normal seeds is decidedly distal in ovaries the rule is that the number of small-sized phenospermic seeds increases as the number of normal seeds diminishes (compare the seed-pattern charts in figure 26). These are nearest to the stem through which ascending food travels to the developing seeds above. Yet they are not using this food in developing to large size. The distribution of the sizes suggests most decidedly that the growth stimulus develops and spreads from above, from the region of the fertilized ovules.

In capsules with the general scattered distribution of normal seeds the number of class-5 and class-6 seeds may be small even though the number of normal seeds is low (see charts in figure 27). In such cases the scattered distribution of the normal seeds rather than their total number seems to be important in increasing the relative number of phenospermic seeds of large size.

The distribution in seed patterns where good seeds are few is of special interest. Plant No. 17 of series 34-15 was so feebly self-compatible that 88 per cent. of the seeds in a capsule (figure 30) were phenospermic. In the seeds of the row marked "2" there is only one normal seed. Above and below this seed are class-4 phenospermic seeds, four in one direction and seven in the other, and next beyond these there are class-5 seeds, and still further away there are class-6 seeds. In row 1 there are only two class-1 seeds which are located in the middle of the row and the phenospermic seeds both above and below in the row grade in size according to distance from these.

Ovules at the same level in separate rows in the same locule do not, it seems, from a study of the seed patterns, affect the development of each other. At the time when fertilization occurs the ovary chambers are small, and the ovules are minute and close together. It would seem that phenospermy is not a response to a stimulus from secretions that may be discharged *within the ovary chambers* by pollen tubes or ovules at this time.

It seems to the authors that the distributions according to size for phenospermic seeds in the capsules of the Lilies studied indicates that phenospermy is induced by definite substances of the nature of growth hormones which spread chiefly *through vascular tissues* from fertilized ovules either at the time of fertilization or later, and that the size of the phenospermic seeds depends chiefly on the distance from such ovules.

CONCLUDING REMARKS.

There has been considerable misconception and confusion, especially in the older botanical and horticultural literature, regarding the

nature and scope of incompatibilities in Lilies. Considerable data on the character and extent of incompatibilities in various species of Lilies have been presented and the limited application of the so-called correlative and plethoric sterilities to Lilies has been discussed quite fully (STOUT, 1923, 1926, 1927, 1931, 1933). But in view of certain recent reports (ABBE H. SOUILLET, 1932, 1933; NEMEC, 1935, 1937) and the attention given to this matter in recent Lily Year-Books (1933, pages 169-171; 1936, pp. 125-126) the following remarks may be made.

The data presented in this paper fully demonstrate that the selective fertilizations of self- and cross-incompatibilities are operating in the one or more older clones of *L. candidum* and in the seedlings of the recently introduced wild stock known as the variety *salonikae*. It is important to note that, as fully as tested, in every case the members of the old clone or clones and any seedling which is self-incompatible will produce splendid capsules with numerous viable seed when there are proper compatible cross-pollinations. *They do this without any special treatment whatever.* It is not necessary to remove bulb-scales, to cut stems from the bulbs, or to add any material of any kind to the stigmas. As already reported for *L. candidum* (STOUT, 1933), even self-incompatible pollen germinates well on a stigma, but its growth is restricted in the style, a condition characteristic of many cases of incompatibility. Possibly there may also be clones for which self-pollen does not germinate, as is reported by NEMEC (1935), but in such a case there will be excellent germination of pollen of compatible relations without any treatment.

A very common error which repeatedly appears in the Lily Year-Books is the view that the individuals of a species are alike in respect to incompatibility. The different seedlings of variety *salonikae* show various grades of self-incompatibility. Some seedlings are evidently completely self-incompatible; some are highly self-compatible. There are certain cross-relations that are incompatible and others that are compatible. This condition suggests the "associate type" of incompatibility which is rather complex both in expression and in heredity (STOUT, 1938). In order to demonstrate fully all the group interactions in the population of any species of *Lilium*, a considerable number of pedigreed progenies must be grown and the members very fully tested for self- and the cross-relations.

The statement that "the Salonika variety bears fruit in English gardens" needs some qualification. A mixed planting of seedlings will certainly contain some that are self-incompatible, but probably each seedling will be cross-compatible with at least some other seedling in the group. Hence cross-pollinations by insects will result in capsules and self- and cross-incompatibilities will not be apparent. But when any fully self-incompatible plant is grown in isolation or is propagated as a clone the numbers of which are grown separately from other clones there will be no capsules, or occasionally poor capsules with few seeds.

The matter of partial self-compatibility and its fluctuating expressions are of special application in respect to the reports that such treatment as removal of bulblets, removal of scales from bulbs, cutting of stem above bulb, etc., may change a Lily plant which is otherwise self-fruitless to a temporary condition of self-fruited. In many species of flowering plants certain genotypes have hereditary factors which readily give partial compatibility with reduced seeding. There may be some setting of seed only during the end-season of flowering, or during the mid-period of flowering in definite cyclic periodicity, or quite irregularly at any time. For some genotypes premature pollination before stigmatic secretion is developed or the removal of secretion will induce some seed setting when incompatible pollen is used. Such results indicate that the reactions of incompatibility which are determined by stigmatic secretions may be modified in certain genotypes to some degree.

In the report by NEMEC in 1935 it is stated that "*L. candidum* produces ripe capsules and seeds after proper fecundation only when the inflorescences have been isolated from the bulbs." The photographs of the capsules which he obtained clearly show only small, poorly developed, pear-shaped capsules. Never were there more than two of these produced on a single stem, and the highest number of good seeds in any capsule was only thirteen. Thus in these studies NEMEC never observed a single flower in which self-incompatibility was changed to a marked degree of self-fruited. There was only a feeble and limited setting of seed in a few of the ovaries involved and apparently no cross-compatibilities were found by NEMEC. In the early experiments of the senior author (STOUT, 1933) capsules of the size and character reported by NEMEC were occasionally obtained on plants of the old cultivated clone or clones of *L. candidum* as frequently when stems were left attached to bulbs as when they were cut and placed in water. Several of these capsules are shown in figure 31.

In his later paper NEMEC (1937) publishes no data for the number of plants studied, for the kind and number of pollinations which were made, for the number and character of capsules produced or for the number of good seeds obtained. But this paper states that different degrees of self-seeding were observed. Individuals of one "Form" produced capsules when the stems were left attached to the bulbs and some of these produced capsules and seeds to self-pollination while others produced capsules only to cross-pollination. It was suggested that this "Form" may be related to the variety *salonikae*. These results suggest, although it is not so stated, that this particular group was composed of seedlings in which both self- and cross-incompatibilities were operating.

But, according to the report, other "races" produced mature capsules and seeds (size and number not stated) only when stems were cut and placed in water. Some of these produced bulblets in the axils of the leaves while others did not. It is stated that in each of these groups some members produced capsules and seeds after selfing

only when the stigma was moistened with sugar solution while others needed no such treatment to yield seeds to selfing. Possibly these individuals were members of the old cultivated clone or clones of the earlier report for which a few small poorly developed capsules were obtained. There are no indications that cross-pollinations were made between these plants and any plant of the "Form" which may have been of the *salonikac* variety.

It may be noted that NEMEC (1935) considered that in plants of *L. candidum* self-pollen does not germinate because the stigmas remain dry, but that when stigmas are moistened with sugar solution the self-pollen will germinate and fertilization will result. He concluded, "Offenbar gibt es bei *L. candidum* für eigenen Pollen in Griffell oder im Ovarium keine Hemmungsstoffe" (1935, p. 12). That this is not correct is obvious. In no case after the treatment did a capsule develop with more than 13 seeds. In the results reported in this paper the self- and cross-incompatibilities both in the population of *salonikac* seedlings and in members of the old clones clearly indicate the action of inhibiting substances which are selective. Also those reactions that are compatible occur on untreated pistils.

It may readily be granted that special treatment of stigmas, such as the application of sugar solution, may modify the natural secretions and effect a partial and feeble fertilization by pollen that is self-incompatible in normal natural conditions to the very limited degree reported by NEMEC. This statement also applies to the effect of cutting stems from bulbs or of removing scales from bulbs. The writers do not understand that any data for size of capsules and number of viable seeds have been presented for any Lily which indicates that any individual seedling or member of a clone which is fully self-incompatible or nearly so has by such treatment been temporarily changed to a high degree of self-fruited.

Any physiological and nutritional influences which affect the incompatibilities of fertilizations and suggest plethoric and correlative relations in the production of fruit and seeds in Lilies, as more recently emphasized by the Abbé SOUILLET (1932, 1933) and by NEMEC (1935, 1937), merely play a minor rôle that is entirely secondary to the very definite and decided action of self- and cross-compatibilities and -incompatibilities in these plants.

In concluding it may be emphasized that self- and cross-incompatibilities operate in and among the sister plants of the same species. They are not to be confused with failures in hybridizing fertilizations. Genetically these physiological incompatibilities are relations which involve similarity in special hereditary factors. There are self- and intra-cross-genotypic incompatibilities, and the scope of action and affects is quite similar to that of other intra-specific differentiations which affect reproduction. For example, in dicecism there is absolutely no sexual reproduction, either self or intra-class, for the members of either sex. The hereditary factors which give these various intra-specific class differences are secondary and in addition to those

fundamental similarities in characters which determine specificity and promote the participations and the reciprocations between members of different classes in the reproduction of the species. Thus, male participates with female; and a self-incompatible member of one intra-incompatible group participates or reciprocates with a member of another group in sexual reproduction.

Hybridizations between species as such concern more especially the basic fundamental qualities of specificity. Similarity in these promotes hybridization, and dissimilarity in these restricts and limits hybridization.

Thus the incompatibilities within species and the failure of hybridization between species are fundamentally entirely different phenomena.

For the excellent execution of the charts illustrating this paper the authors are indebted to Mr. F. H. CATALDI and to the Works Progress Administration which afforded his services.

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RANDOM NOTES ON FRITILLARIES.

By P. ROSENHEIM.

THAT supply will follow demand applies in the horticultural trade as in others and, during the last few years, it has been possible for amateurs to purchase an increasing number of *Fritillaria* species. This is all to the good. The popularity of the tribe suffers to some extent from reputed difficulties of cultivation, and it is part of the object of these notes to dispel that fear and to attract new disciples. A former article* dealt fully with cultivation of *Fritillaries* in pots, and there is little useful to add. Owing to an increase in the collection, frame room was not sufficient and the overflow had to be plunged in the open. Although these pots were subject to a greater amount of moisture in comparison with those in frames, no disadvantage could be found. We cover the pots here, several inches deep, with Sorbex peat, but we noticed in Dr. STOKER's garden that the collection was plunged to the rim only. Since then we have heard of more growers successfully using the same method, and we intend making trials with several pots containing the same species plunged in different ways.

Miss BECK, a very successful grower of *Fritillaries*, raised the point† whether corms should be repotted yearly or left in the pan for a second season. Miss BECK seems to favour the latter method, but we cannot see in it any advantage for any corm or bulb whose roots die off completely like those of *Fritillaries*. Repotting disposes of exhausted soil and at the same time renews drainage. Owing to an unavoidable cause, potting was delayed here by a fortnight and it was noticed that root growth had already started with several species although the pots had no water for three months.

With regard to raising plants from seed it is pleasing to note that an increasing supply of *Fritillaria* seed is now available. We suggest treating seed very much like that of *Nomocharis* with the proviso that sowing should be completed in the autumn, or as soon as seed is available. Deepish boxes or pans are good for the purpose; the soil should consist of a porous mixture of fibrous loam, leaf-mould, or peat and sand, the drainage must be ample, the seed should be spaced and lightly covered with soil. The small bulblets may be left in the seed boxes for two or three seasons, then, unless still too small, they may be planted out in their permanent quarters. *Fritillaries* from seed are slow to reach maturity and may take up to six or seven years before flowering. Offsets may be sown and treated like seed, and these will

* Lily Year-Book 1935, p. 93.

† Lily Year-Book 1936, p. 12.

come quicker into flower. Where the supply is plentiful, seed may be sown direct in the scree. Experiments here look promising, yet it is too early to report. The man in charge of the garden must know the difference between seedlings and weeds, and should have a deft hand.

I write with some diffidence about hybrids, because I have never heard of any cross made between two species, simultaneously deliberate and successful. At the same time I should not be surprised if natural hybrids exist especially amongst Balkan species. The Dutch varieties of *Fritillaria Meleagris* may be either selected variations and/or intervarietal crosses. The same remarks hold good for *F. latifolia*, with the proviso that either *F. lutea* or *F. aurea* or both may have been used for mating. The third example is *F. imperialis*, which has been intercrossed by the Dutch florists for nearly three centuries. In each case the results are variable colour forms, and the size of inflorescence may increase, but there are few alterations in leaf. A coloured drawing of a reputed *F. Meleagris* × *latifolia* hybrid (coming from Colesborne) shows, to my mind, pure *F. Meleagris*; another form called "Porrong" is also a beautiful form of the same species. But when we observe *F. graeca* there occur many extraordinary variations, not only in the pattern of the flower, height of stem, but also pronounced discrepancies in the leaf. These may be straight or twisted (like *F. obliqua*) narrow, or broad, or slanting. The broad, upright leaf distinguishes *forma thessalica*, shown so well by Mr. G. P. BAKER. Some vary so much that hybrid influence (*F. macedonica*) may be suspected.

The garden varieties of *F. Meleagris* are fertile, but *F. latifolia* is always sterile here. Is this a case similar to the "Dutch" *Crocus*? One hears, occasionally, remarks about the reversion of colour forms of *F. Meleagris* to white. Although a change in an individual is hardly possible, whites sometimes appear to be dominant. Colour forms may die out and may be replaced by white seedlings. It has been computed that, in a certain meadow near Wachenheim, Palatinate, white specimens predominated by 97%.* CASPAR BAUHIN (1560-1624) distinguished between the early-flowering broad-leaved and late-flowering narrow-leaved varieties of *F. Meleagris*.†

F. Meleagris in Nature likes to grow in meadows liable to periodical inundations.

The Crown Imperial was introduced to Europe between the years 1570-1575. It is much regretted that this former favourite of the cottage garden here and on the Continent is no longer popular. It will grow in any soil, but prefers a sound loam. The bulbs are poisonous, but lose their toxic qualities after cooking. It is reported that large quantities are grown commercially in France for the sake of starch, of which the bulbs contain 23%. There is a form called *inodora*, which may appeal to people objecting to the offensive smell of the type. Crown Imperials are self-sterile. We have seen it reported in a German

* Hegi, Flora von Mittel Europa, vol. II., p. 241.

† Rümpler, Zwiebelgewächse, Berlin, 1882.



FIG. 32.—*Fritillaria messanensis* ON MOUNT OLYMPUS.



FIG. 33. *LILIUM LEICHTLINII*.
(p. 160.)

periodical that Blackcap Warblers in search of insects succeeded in fertilizing Crown Imperials.*

Mr. W. SCHACHT, of the Royal Gardens, Vrana, was kind enough to send a photograph of *F. messanensis* (fig. 32) growing on Mt. Olympus, Thessaly. I sent it to Dr. TURRILL of Kew, who wrote:—“I knew of the existence of such a plant on the Thessalian Olympus but have no specimens. It certainly comes near *F. messanensis* Raf. but I am not prepared to say that it is this species. All the authenticated material I have comes from Sicily, and so far as I know for certain the species is limited to that Island.” We have been trying to find out a little about this Fritillary of which many speak, but very few know. In our researches we came across the actual description by RAFINESQUE† in the Linnean Library, and there is no doubt that he described the Sicilian plant. The author lived about ten years in Sicily (1805-15) before settling in the U.S. America. Messina, Sicily, was formerly spelled Messana, (Smith's Latin-English Dictionary 1877); Messene, the capital of Messenia, Peloponnesus does not come into consideration as RAFINESQUE did not collect there.

The first reputed illustration of this elusive species appeared in REICHENBACH, Icones,‡ but unfortunately the figures do not represent *F. messanensis*, but probably *F. neglecta* (wrong colour), and it becomes obvious that from that period onwards *F. messanensis* has been frequently confused with other members of the Mediterranean group, such as *F. tenella*, *F. neglecta* and *F. nigra*. It is remarkable how often *F. messanensis* is cited in Floras of countries bordering on the Mediterranean. An illustration in the Gardeners' Chronicle (1885), fig. 156, also depicts a wrong plant with tessellated flowers. The third figure is in Fiori and Paoletti, Icones (1895), p. 73 (fig. 632), correct, but poor. A fourth appeared in 1851 in La Belgique Horticole (vol. 1), together with an article by M. CH. MORREN. The outline of this figure is probably correct, but the colours are wrong; green for *petalis luteis* and the margin pink for *margine purpureis*. The drawing is correct as regards the main point of the author:—*petalis . . . non tessellatis.*

A note in Flora Sicula by M. LOJACONO POJERO (1908) gives the colour of the petals as *viride-lutescente*; another by GUSSONE in Prodromus Flor. Sic. 1827, mentions 1-4 flowers to the stem.

The distinct colour band on the crest of the corolla *F. messanensis* shares with *F. lusitanica*, but it is even more pronounced in *F. rhodocanakis* Orph. & *F. macrantha* Baker, of which Mr. INGWERSEN kindly sent me a flower collected in Greece. *F. messanensis* used to grow in open pine woods near Messina, Sicily, but as the woods have been denuded it may be rare now.

I had the privilege of spending a day in the charming garden of Mr. JOHN GRAY, Saxmundham, where *F. pallidiflora* is perfectly at home

* Wehrhahn, Aus der Natur, 1906.

† Rafin. Préc. p. 44. Paris 1814.

‡ Reichenbach, Icones. vol. X., fig. 981/2.

and seeds freely in most unlikely places. The garden is well cultivated, but full of elm roots, yet this Fritillary is absolutely naturalized. Root association is a wonderful thing, but I would not pick out an elm to do the trick. Contrary to textbooks, *F. pallidiflora* bears, usually, 2-4 flowers. I have seen an illustration by Lt.-Commander FURSE, showing a rose form with distinctly coloured margins. This is an illusion ; the flowers frequently turn pink when fading.

One of the newcomers of the year was *F. lusitanica*, kindly given me by Mr. GRAY, who collected corms in Portugal some twenty miles away from Lisbon, many years ago. The species seems to be related to the *nigra-montana-tenella* group. The stiff stems are a little over a foot high and carry, usually, two flowers, which are very variable in colour. Some are chequered, some are not, most are very campanulate, a few straight, but all show a yellowish colour band on the crown. One plant possessed such a strongly coloured median band that, if cut down to the same length, it might have been easily mistaken for *F. graeca*, another for *F. graeca* var. *Guicciardii* (without median band). The bearing of the species reminds one of *F. acmopetala*, rather stiff, yet graceful.

Corms received last autumn from a Continental dealer, under the names of *caussolensis* and *tenella*, proved all to be of *nigra (montana)* type, the very plant which is frequently sold under the wrong name of *F. oranensis*. The true *F. oranensis* showed little variations in cultivation until Mr. BALLS introduced new blood from Morocco under B 2817 and B 2842. These are good plants of great consistency. One of the most graceful Fritillaries is the well-named *F. gracilis*, a very dainty plant recommended for the cold house.

While pot plants were exceptionally late, the garden season was well in advance and many species flowered simultaneously in the open and under glass. The first species in the cold house to unfold was *F. aurea*, which was in full flower on March 1, a very late day in comparison to former years. In the scree the honour fell to the American *F. Purdyi* on March 19. It is pleasing to report that the colony, which flowered for the third season, is getting stronger and that the slight protection given by small Daphnes is apparently to its liking. A plant with nine flowers was still in good condition at the beginning of May, and entirely untouched by many heavy night frosts. On previous occasions we have suggested that an earthy scree, or a stony bed, is an excellent medium for cultivating the family. Mr. BALLS, writing in the Gardeners' Chronicle,* stated that he found *F. graeca* in quantity in scree during a recent collecting trip in Greece. Here this method of cultivation has proved so far successful.

On April 11 occurred a very heavy frost, when 7° were registered on a thermometer fixed to the wall of the dwelling-house 5 ft. above ground. This would imply over 15° on the grass. While *Lilium regale* was heavily damaged, and *L. Henryi* 2 ft. high doubled up, no visible

* Gard. Chron. 1937, p. 464.

damage was done to a fairly large number of species and individuals of Fritillaries in flower, amongst them *F. pallidiflora*, *F. Purdyi* and *F. lanceolata*. These frosty nights continued for a long time.

The most recent and extensive horticultural monograph on the genus *Fritillaria* is included in Wehrhahn's *Gartenstauden*.* It is based on the classification devised by J. G. BAKER, who divided the genus into ten sections. Section 2, *Notholirion*, has since been made a separate genus. Amongst the remaining nine sections (of which two each contain a single species) 49 species are described, but the classification leaves a good deal of room for reform, and the caption of one illustration is wrong. In the third volume of *The English Rock Garden* Dr. S. CLAY† gives a somewhat flippant account of some 30 species. For some we cannot find an authority.* We have experienced no greater difficulty in cultivation of American species (except *F. recurva*) than those of other Continents.

It will take years of painstaking work for a trained gardener-botanist or botanist-gardener, progressing on the lines of the late Mr. DYKES with Irises, to get some order out of the present chaos.

While we consider most Fritillaries as easy of cultivation in any gritty and well-drained soil, they are usually not a success in badly drained gardens, even if we bear in mind that some species actually grow in water meadows. Always remember that most species are not fixed and extremely variable as to size, colour and leaf, and do not imagine that every variation represents a different species. Just think of the many forms of our native *F. Meleagris* and you will understand.

We repeat our former advice : Sound bulbs, perfect drainage, and no coddling.

* Wehrhahn, *Die Gartenstauden*, 1931, vol. I., p. 113.

† "The Present-Day Rock Garden," by Sampson Clay, M.A., Ph.D., 1937, p. 233.

WESTERN AMERICAN FRITILLARY NOTES.

By CARL PURDY.

I HAVE re-read Dr. W. B. TURRILL's address in R.H.S. Lily Year-Book for 1937, in which he gives a skeleton outline of the sections of this genus.

Under *Liliorhiza* he says "Characterized by the many-scaled bulbs."

I do not know just what species he would include in this group, but it is well to call attention to the fact that certain species of which *Fritillaria biflora* is one are characterized by a bulb that is absolutely distinctive.

Included in the group are *F. liliacea*, *F. biflora*, *F. agrestis*, *F. Purdyi*, *F. pluriflora*, *F. striata* and some unnamed forms or species.

The bulbs are composed of large separable scales united only at the base. There is no character in the leaves or habits that is reliable and a plant of any of them out of flower could be taken for any other.

• Alike they only grow in full sun and in heavy clay soils. Alike they are very deep seated. A depth of a foot is common, and few are less than eight inches deep. Hybridization either with each other or other Fritillaries is impossible, both because all flower early and before others and because others are shady land or woodland species. Together they form a most distinct group with no affiliations.

I have mentioned *F. striata*. This species has never been available for cultivation, but it is a lovely thing. The basal colour is near white, but so closely covered with lavender pink lines as to appear that colour. Alone amongst Fritillarias I think, it has a very pronounced and sweet fragrance. It is found in heavy clays at low altitudes in the foothills at the base of the Southern Sierra Nevada Mountains.

In other West American Fritillaries the bulb is a disc, or in some species a cone, of solid white matter and set loosely on this disc or cone are small rounded and often rice-like offsets. These rice-like grains rattle off easily from the ripe bulb and greatly help to reproduce the species.

In *F. lanceolata* this trait is the most marked, and I do not doubt that one bulb might have 200 set closely and bead-like. The fresh bulb is a thing of beauty. *F. recurva* is only less marked, while *F. recurva coccinea* has few offsets.

Natural hybridization of any of these other species is usually very unlikely because it is seldom that two of them grow adjacent.



FIG. 34.—*LILIMUM POLYPHYLLUM* IN COUNTESS GREY'S GARDEN.
(p. 161.)



FIG. 35.—*Nomocharis pardanthina* AND *N. pardanthina* FARKERI IN MR. GREG'S GARDEN, VANCOUVER IS.

(p. 137.)

(See fig. p. 129.)

In one locality however, three species were within a quarter of a mile. They were, *F. coccinea* in typical form, *F. lanceolata*, and *F. phaeantha* which is allied to *F. lanceolata*.

The area having *F. coccinea* was in the middle and wide, the areas having the two other species were small. At both points of contact there were unmistakable hybrids. Those between *F. phaeantha* and *F. coccinea* were decidedly pretty in a brownish red. The *F. lanceolata* cross showed in very much larger scarlet flowers. At another point quite distant the same contact occurred with like results reported.

WESTERN AMERICAN LILIES.*

By R. W. WALLACE, V.M.H.

TIME is too short to do justice to my subject, when we consider that the area covers over one thousand miles from the Columbia River in North Oregon to Southern California and the borders of Arizona—a vast region, mountainous practically throughout, with forest and mountains, rivers, and great differences of altitude, local climates and varying vegetation and soil conditions.

Some thirteen species with seven varieties, making about twenty types in all, are to be found within the area, but it is not a question of Lilies all the way and everywhere, but isolated colonies in situations far apart. Try to picture such a country so as to understand more fully, the difficulties of cultivation which attend these members of the Lily family, from the wild regions and solitary mountain ranges on the Pacific coast.

To simplify matters we may, I think, divide them into three groups. First, those that are found growing in moist conditions, so-called bog Lilies, but not for successful cultivation in a bog. They are :—*L. pardalinum* and its forms, *L. Roezlii*, *L. Parryi*, *L. parvum*, *L. parviflorum* (now *nevadense*), and allied to them, but calling for different conditions are *L. maritimum*, *L. occidentale* and *L. Bolanderi*, whose cultivation is more difficult. Then we are left with *L. Humboldtii* and its forms, *L. columbianum*, *L. Washingtonianum*, *L. rubescens* and *L. Kelloggii*; these are found growing under considerably drier conditions than the former. We will briefly consider how these Lilies are found growing in Nature, and think of our successes and failures with them in this country.

L. pardalinum and its many fine forms we all know and grow, some more successfully than others. It is possibly the most widely spread of all Californian Lilies, from near the Mexican border to 90 miles south of Oregon it is always found in colonies. These may be far apart. They may follow a living stream either on its banks with their roots going to water; or in silty alluvial deposits always moist; in little valley areas of any rich soil either alluvial or other soil with leaf mould fairly plentiful; around springs as far as their moisture keeps the area barely moist; or rarely on the edge of, or on hummocks of real bogs. Soil and conditions which suit potatoes suit this Lily and may suit it better than any natural conditions.

* This article was written in 1935 for one of the Discussions at the Lily Group but had to be held over till now on account of lack of space.

PURDY says the finest lot he has ever seen was in an open meadow-like valley in the Sierras at 4,000 ft. There were thousands of them.

It is a Lily for anyone with fairly good garden conditions, and if a shady cool corner amongst shrubs can be found it will be at home.

L. Roezlii is another easily grown Lily, close to *L. pardalinum* (but the rhizomes do not branch) and thriving in very wet conditions. Dr. VOLLMER says, he has seen it growing in water; it certainly is a variety for heavy wet soils. PURDY says he has seen it on the borders of swamps which are solid colonies of Darlingtonias (Pitcher Plants). The habit of the plant resembles *L. pardalinum*, but it is more slender and with yellow flowers with maroon spots, in shape mid-way between *L. pardalinum* and *L. Humboldtii*. It is found up to four or five feet high, with thirty flowers. There is another form wherein the flowers are deeper in colour, with narrower foliage; this is found in similar conditions where the soil is heavy and winter wet.

L. Parryi is perhaps the most beautiful of Californian Lilies, with its clear yellow flowers more or less spotted. It has been grown in perfect form in this country from time to time. The late Capt. REID grew it with 39 flowers on a stem. It was found in South California in 1886 growing in a moist potato patch some 4,000 feet above sea level in a cool damp climate. It is also reported from Arizona 7,000 to 11,000 feet, covered with snow and ice for six months. It is a difficult Lily to handle on account of the brittle nature of the scales. *L. Parryi* is the most southern Lily and therefore found at a higher elevation covered with snow in the winter which provides summer moisture. It grows in silty loam in moist meadows.

We now come to *L. parvum*, of which there are two forms, the type red and spotted, and the yellow form *luteum*, which is a most effective little bright golden Lily. A slender growing Lily from high altitudes, the yellow form is found growing at 4,000 ft., on the floor of the Yosemite valley, on little hummocks in swamp-like areas. It is also found up to 6,000 ft. either in grass or among low shrubs and scattered plantings in moist places, or following little streams in soil rich with leaf mould, moist in the growing season, but frequently dry when growth is finished. It will grow five to six feet high with up to thirty flowers.

Where *L. parvum luteum* ends *L. parvum* begins in higher altitudes, and is found growing up to 8,000 feet. It is an alpine form and does not grow so tall, sometimes only 18 inches high. It is variable in soil surroundings and is found sometimes in sand and leaf soil and at other times in peat soils.

The Lily called at one time *L. parviflorum* or *L. pardalinum minor*, now ranks as a distinct species under the name of *L. nevadense*: a slender-growing *L. pardalinum* growing in moist meadows amongst Willows and Alders—variable soils—frozen hard in winter amidst snow and ice, it will stand conditions similar to *L. Roezlii*.

Closely allied in bulb formation and growth are *L. maritimum*,

L. Bolanderi and *L. occidentale*, a trio of interesting Lilies, though possibly not possessing such striking beauty.

L. maritimum is usually found growing close to the coast-line, where winter rains keep the ground moist when the bulbs are at rest with summer fogs frequently drenching the plants with moisture. It is found growing in raised hummocks in bogs, in open situations and again in dense thickets. Flowers drooping, bell-shaped, dark red. In cultivation a good loam with ample drainage seems to suit it.

L. Bolanderi, which from its appearance is in a class by itself, has small trumpet-shaped crimson flowers, recurving like a Fritillary. It evidently revels in moisture, the rainfall being heavy, and grows about 3 feet high, carrying 6 to 7 flowers.

L. occidentale is very scarce in Nature and widely spread, sometimes found growing 8 to 9 feet high with 20 flowers. With rain in winter and some fogs it rejoices in damp, well-drained conditions. The bulbs are usually found amidst the roots of shrubs which help to keep it dry.

Now for the giant Californians, *L. Humboldtii* and *L. Washingtonianum* groups, the former found growing in stiff heavy soils among scattered Pines, where there is not much humus in the soil. The bulbs are deep, hence they find moisture. It is a grand Lily with clear, deep yellow flowers with maroon spots; up to 10 feet in height with 40 flowers. It rejoices in sun. There are allied forms, but the finest form is *L. Humboldtii magnificum* or *ocellatum*, stem-rooting and easier to establish. This is found in open woodland, sloping to the water, but always above water in rich loam and leaf soil containing gravel and rock, and with good drainage. PURDY writes: "When all conditions favour, its size is remarkable and outstrips *L. giganteum*. Take plants 10 ft. to the first flower with 65 flowers. A bulb with 83 blossoms, a bulb with two stems and 150 flowers, and you have a hard record to equal."

L. Washingtonianum and its varieties *minor* and *purpureum* are generally found in strong soils, well drained, at high altitudes with moderate rainfall. It is widely spread and is found at its best above 6,000 feet covered with snow from November to April, and bears 25 flowers or more. It is described by those who have seen it in Nature as a magnificent plant with its stout stems and whorled foliage, crowned with semi-trumpet-shaped flowers delightfully fragrant. So far it has not been seen in its finest form in this country, except on very rare occasions.

L. rubescens, though close to the former, is yet distinct in bulb and in shape of flower, which is tinged with pink as it ages. Growing up to 9 feet high with 30 to 40 flowers, it is generally found facing north in open ridges, always amongst low brushwood and with perfect drainage, in a soil loose in character.

L. Kelloggii, the last of Californian Lilies to be introduced to cultivation, is generally found growing in clay-like soils and grows 5 to 6 feet, carrying up to 20 flowers, Martagon-shaped, very recurved,

pink and deep lilac with a central streak of yellow. It is the only Lily of this colour in N. America, a connecting link with *L. cernuum*, occasionally found in shade in deep loam up to 10 feet high and with 70 flowers.

L. columbianum is a miniature *L. Humboldtii*, very widely distributed from California to the Canadian border, growing from sea level to 1,000 feet, in many types of soil where there is good drainage and moderate moisture. It grows from 3 ft. to 5 ft. high with up to 40 flowers—a graceful Lily.

The above short summary brings under review all the Californian, Oregon and Pacific coast Lilies.

From the foregoing remarks we gather that the best conditions for successful cultivation in this country would be in most cases open woodland of an undulating character, with scattered under-growth of shrubs, and perfect drainage, with small streams of water or damp ditches. I can imagine Coolhurst as a perfect setting for many types, and there should be many such a position to be found here, especially on the west or north coast.

The absence of successful cultivation in the past has frequently been due to the difficulties attending the collection of the bulbs and transport to this country; most kinds have very brittle bulbs and travel badly. However, nowadays they are being cultivated in their natural habitats, so that a much better stock is available.

It is a curious fact that nearly all the species are more or less alike in form of flower and leaf growth, and similar to *L. pardalinum* (excepting *L. Washingtonianum*, *L. Parryi* and *L. rubescens*) with shortened trumpet-shaped flowers nearer to the Eulirion group, but with leaves in whorls. They form a connecting link with the Lilies of the East.

SOME NOTES ON WESTERN AMERICAN LILIES.

By CARL PURDY.

ON re-reading my article in R.H.S. Lily Year-Book of 1935 I find that by inadvertence I omitted one well-marked Lily.

Lilium Bloomerianum might as well be *L. Humboldtii magnificum minor*. The name *L. Blocmerianuen* has, however, long been in use.

It is in every way a miniature of the type. Seldom over $3\frac{1}{2}$ ft. high it has a slender stem with the leaves in whorls and small flowers in reddish orange with maroon dots each circled with red.

The miniature habit is constant. Under the very best circumstances and planted side by side with the type they will be about one-third the size.

San Diego Co. is the southermost county in California and joins the province of Lower California, Mexico. Its tablelands are semi-arid and small mountain masses rise precipitously to as much as 10,000 ft. At about 4,000 or 5,000 ft. the rains are more abundant and the flora is of pines, oaks and other northern trees.

Here this little Lily is common.

L. pardalinum 'Orange Glow' was introduced by myself a few years ago. While it is a very distinct form I did not and do not think it worthy of specific rank so it has never been described botanically. My catalogue description is its introduction to the garden.

With the characteristic rhizome and foliage of *L. pardalinum* its flower is only faintly red at the tips of the segments and in some plants it is altogether orange, and always thickly dotted maroon. As the slight red tips are folded under in full bloom it is to the eye an orange Lily and one of much beauty. No other *L. pardalinum* is fragrant, but this variety is distinctly so.

ROBERT WALLACE thought that its characters indicated an approach to *L. Warei*, but there I disagree for *L. Warei* had three-jointed scales to the bulb, and its fragrance was, I believe, akin to that of *L. Parryi*.

Along with other writers I have stated the usual number of flowers carried by a Lily species, but of late years I have known of a number of instances which show that conditions rather than inheritance largely govern that trait.

Here are a few instances.

L. regale with a hundred flowers and a field of them in Oregon, with many bearing forty to fifty flowers.

L. rubescens is oftener found with three to eight flowers, yet I have seen them with 35 in the wild. A friend in California showed me a seeded stem which showed a hundred. The year before the same plant had 150.

L. Humboldtii magnificum often becomes a very stately plant growing 6 to 8 ft. high with up to 65 flowers. One garden-grown plant had a stem the first year with 75 flowers and the next year the same bulb produced two stems with 150 flowers. A well authenticated stem in the wild was observed with 65 flowers and about 16 ft. high.

L. Kelloggii is normally as it grows wild from 18 in. to 4 ft. high from a seedling with only three scales, but last fall a bulb came to me that measured 14 in. circumference.

Surely if exceptional conditions will do things like these we may hope to learn to surpass by far what we have achieved in the garden.

And may I be pardoned if I transgress to tell of a plant of *Calochortus amabilis* in the same garden that produced the large *L. rubescens*. This plant had 150 flowers as against a normal of at most 18, and a usual of three to eight.

In the Lily Year-Book for 1936, on p. 42, Mr. CRAIG mentions the hybrid Lilies produced by Dr. GRIFFITHS of the U. S. Dept. of Agriculture from seed I had and of which I had lost trace of the origin.

I have been rather sure that the seeds were sent me by ROBT. KESSLER of Los Angeles under the label of *L. Humboldtii magnificum* and recently took up the matter with him. Mr. KESSLER wrote that he had collected most of it from the wild but supplemented with seeds from plants in his garden.

Growing in his garden were *L. Parryi*, *L. Roemii* and *L. Humboldtii magnificum* but no *L. pardalinum*.

Plainly the seed was cross-pollinated there.

In the Southern Sierra Nevada Mountains two forms of *L. nevadense* are found. This Lily has long been called *L. parviflorum* and before that *L. pardalinum minor*. One form has orange or yellow centres and red tips, while the other is lemon yellow, both dotted maroon. ROBERT KESSLER writes of finding the yellow form at 9,000 to 11,000 ft.

I have only found one locality in which I was satisfied our Lilies hybridized. This was at about 4,000 ft. in the Sierra Nevadas.

Both *L. pardalinum* and *L. parvum luteum* in their typical forms are there and at times intermingle and there are very many hybrids combining their characters in varied ways.

In that section of N.W. California where so many Lily species are found (see R.H.S. Lily Year-Book 1935, p. 43) there seems to be a tendency to develop new species or forms. These are not, however, hybrids because two species do not grow close enough together to

hybridize. It seems to be due to very greatly varying conditions of soil, moisture, elevation, etc. I could segregate at least two intermediates between *L. pardalinum* and *L. Roemii*. Last year I flowered plants which indicated intermediates between the two very unlikely-to-cross species of *L. Bolanderi* and *L. columbianum*.

In another region red-flowered *L. columbianum* are not uncommon. In still another a very striking form of *L. pardalinum* is found paralleling *L. pardalinum giganteum*.

THE CULTIVATION OF NOMOCHARIS IN BRITISH COLUMBIA, CANADA.

By E. GREIG, Vancouver Island.

THIS Province is so large, and has such a diversity of climatic conditions, that the above title should more properly refer to the cultivation of Nomocharis on Vancouver Island, because the experience of the writer of these notes has been confined to central Vancouver Island.

As we have had such a limited experience with the genus, it is with some diffidence that the following remarks are offered. However, they are given for what they are worth in the hope that they may be of general interest, and perhaps of some value to those who grow or would grow them on the Pacific Coast of North America.

The writer's first introduction to Nomocharis was in the garden of Mr. and Mrs. BUCHANAN SIMPSON, several years ago. *N. pardanthina* was then blooming for the first time in this part of the world, having been grown by Mr. SIMPSON from seed. To see was to desire, and the following spring several bulbs were transferred to our garden at Royston. They took to their new home so happily that we have been growing various species with increasing enthusiasm ever since.

As can be seen by a glance at the accompanying photograph (fig. 33), which shows one of our main plantings of *N. pardanthina* with a group of *Nomocharis pardanthina* var. *Farreri* at the far end, the plants take kindly to our Western conditions. This particular bed faces north-east, is fully exposed to the morning sun, but receives only dappled sunlight for the remainder of the day, being protected by light shrubs.

No article of this nature would be complete without some information as to soil, rainfall and climatic conditions generally.

Our soil, of a light gravelly nature, is almost entirely lime-free, as is attested by the ease with which all hardy Ericaceous plants can be grown. In making up a bed of Nomocharis we usually dig to a fair depth and mix in a generous allowance of good oak or alder leafmould. The beds are kept mulched at all times with a mixture of peat and leafmould, providing cool rooting conditions.

The average rainfall amounts to about 44 inches, most of which is precipitated in the late autumn and winter, though the early summer is quite often wet and unsettled. As a general rule the summer and early autumn months are fine and warm, with considerable sunshine.

Winter conditions are variable. Occasionally we are favoured with a mild and open winter, with perhaps not more than 20 or 25 degrees of frost, and sufficient snow covering during cold spells to

keep frost from penetrating to any depth. More often we have killing frosts in October or early November, sometimes with temperatures ranging down to almost zero, then more or less open weather until Christmastide, when we can expect a drop to as low as three or four degrees below zero (F.) with or without snow on the ground. January and February may be mild and wet, or more usually snowy and bitterly cold with a penetrating north wind and sub-zero temperatures. Our winter conditions are much more severe than those obtaining in more favoured localities, such as Victoria and Seattle, yet we have never had the slightest difficulty in growing and flowering such species as we have been able to obtain.

Despite the variable winter conditions, self-sown seedlings frequently appear in the beds. Our main bed contains a number of plants of *Omphalogramma vinciflorum*, which flower before the *Nomocharis* have made much growth and seem to appreciate the subsequent shade given by their taller neighbours.

Up to the present time we have not experienced any difficulty with pests or diseases, despite the fact that nearby groups of Lilies are occasionally touched with Botrytis, which one would expect to spread to the *Nomocharis*.

The following species have been flowered at Royston up to the time of writing, June, 1938 :—

N. aperta, *N. lophophora*, *N. Mairei*, *N. pardanthina*, *N. pardanthina* var. *Farreri*, and *N. Sordiei*.

Seedlings and young plants, as yet unflowered, of *N. Mairei leucantha*, *N. nana*, *N. oxypetala* and *N. saluenensis*, are being grown on.

Propagation is carried on by means of seed and scales, the latter method being generally used. We do not find much apparent loss of vitality occurring as a result of scaling.

LILIES AT THE " JARDIN D'ESSAIS DU CHEMIN DE
PUTDAEL," AUDERGHEM-BRUSSELS.

By Dr. A. DEKEYSER and A. DELVAUX.

SOME years ago we created the "Jardin d'essais" with the purpose of encouraging in Belgium the taste for hardy ornamental plants other than those so widely spread that one can see them everywhere. We were already in possession of a fairly important collection of choice plants, for we started to gather the first specimens a long time before the Great War. Among a lot of other things we had in our grounds a series of Lilies which had become acclimatized and flowered each year regularly. About four years ago we decided to establish a collection of Lilies as complete as possible, in order to supply the University of Brussels with the necessary material for the systematic study of the species and, in consequence, we tried to grow them in borders or in pots, according to their hardiness. We were very much helped by the publications of the English botanists and amateurs and the Year-Books of the Lily Group of the Royal Horticultural Society of London.

It is the results* of those first trials which we publish today; we think that it is only by observations made on a large scale on numerous species, varieties and strains that we can grasp the differences of constitution and behaviour of plants and that it is the only way to understand their particular requirements.

Our "Jardin d'essais" is situated in mid-Belgium, in the eastern outskirts of Brussels, about 90 yards above sea level. In consequence of the winds coming from the Baltic plain, the climate is notably more severe than that of London and its environments, with differences of temperature and dampness more frequent and more sudden. It is not unusual to see the thermometer go down to 10° or 5° F. and sometimes more.

The soil of our garden consists of heavy clay mixed with sand, poor in chalk and in humus. The subsoil has the same composition, is more or less pervious, but during the summer it remains cool a long time. The ground slopes slightly to the south-west; it is open and fully exposed to the sun, and is somewhat sheltered from the northern and eastern cold winds by screens of trees and shrubs.

The Lilies are mostly cultivated in borders, arranged in groups scattered among the other herbaceous plants of our collections. One of these borders runs along a hedge of privet about two yards high and enjoys a certain amount of shade during the hottest hours of the

day; the species which most dislike the scorching sun are grown there. Basins supplied with water of the municipal distribution pour off their overflow in pipes pierced through from place to place, which run underground to moraines established to cultivate the most difficult American Lilies, which want a lot of moisture in the subsoil during the summer. Glass frames on bricks, without any artificial heat are used during the winter to shelter the plants grown in pots. Lilies cultivated in the open ground are grown in holes or pockets measuring at least one cubic yard, filled with compost carefully prepared according to the needs of each species, as described by the most authoritative English writers.

We did not start sowing Lilies soon enough to be in possession of bulbs of flowering size. Therefore all our groups are made of bulbs obtained from well-known firms of England, Japan, North America and India.

No special care is taken of our cultures except during the winter a covering of boughs of fir on the less hardy species and some watering during the summer, when dry weather is of too long duration.

In, order to make it easier to find the observations relating to each plant and to compare them with the results obtained by other people, all our species and varieties are put in alphabetical order and, as for the names, we follow the nomenclature of WOODCOCK and COUTTS in their book, Lilies, their Culture and Management.

Lilium amabile Palibin—3 colonies.* Not too strong, but flowers regularly. So far has not increased much.

L. aurantiacum Weston—2 colonies. This Lily or a hybrid very near the type is frequently met in the gardens of Belgian cottages, where it grows in most various soils, without any special care. It is strong, floriferous and multiplying. We know clumps giving yearly some dozens of strong stalks bearing large quantities of flowers.

L. aurantiacum var. *Chiaxii* (Maw)—2 colonies. This is far from being as strong as the type. It is a dwarf variety, not very floriferous, often disappearing if cultivated in borders. As it is of alpine origin, it may be that one could better succeed if it were grown on a gritty and rocky slope.

L. auratum Lindley—5 colonies. Usually, the newly imported bulbs gave a fine display of flowers the first year, but after that the plants seem to be exhausted and disappear progressively without even leaving any offset-bulbs. We have, however, known plants which flowered many successive years on the same spot.

Up to now we have not got better results with the varieties *pictum*, *platycarpum*, *platyphyllum*, or *ruberovittatum*.

L. Bakerianum Collett and Hemsley—3 lots. A very fine species, but in our climate must be cultivated in pots or better still in open

* When the Lilies are cultivated in sufficient numbers, we point out, after each name, the number of small groups, colonies or pots, each of those lots being made of bulbs from various sources of supply.

ground in a conservatory, where it seems easier to keep in good health than in a pot.

L. × Bellingham Hybrids (var. 'Douglas Ingram,' 'Sacajawea,' 'Shuksan,' 'Star of Oregon.') A big future seems to be promised to these hybrids. Besides their ornamental qualities they are vigorous and floriferous and quite hardy under a covering of boughs of fir.

L. Bolanderi S. Watson—(3 lots). After many trials we have not succeeded in acclimatizing this Lily, the imported bulbs flowering only once to die afterwards.

L. Brownii F. E. Brown—2 lots. We cultivate this Lily in pots. It is strong and floriferous.

L. Brownii var. *colchesteri* E. H. Wilson. Cultivated in the open ground, it withstood well the cold and dampness of the last winters.

L. bulbiferum Linnaeus—2 colonies. With us this Lily has never been strong and the stalks were never more than one foot high. Some plants died without other apparent reason than the great dampness of our winters. As it is an alpine plant, we suppose that a gravelly slope would suit it better, and we try now to grow it in that way.

L. × Burbankii var. 'van. Tubergen'—4 colonies. All bulbs received under this name died.

L. × Burbankii var. 'Napier.' Three lots received under this name succeeded very well and now are forming vigorous and regularly floriferous colonies.

L. callosum Siebold and Zuccarini—2 colonies. Although they have all the appearance of healthy plants and flower well, the number of stalks of each colony is diminishing rapidly from year to year. The plant, very similar to *L. pumilum*, has probably a short life in cultivation, like the last one.

L. canadense Linnaeus—7 colonies. The seven parcels received had quite different fortunes: three disappeared very soon, one is still languishing, but the three remaining lots became stronger and stronger and give promise of soon forming prosperous colonies.

L. candidum Linnaeus—8 colonies. This Lily, one of the most generally cultivated in our cottage-gardens, is there usually strong and floriferous. However, sometimes all the plants of a colony very soon lose their leaves and flower very poorly. As in spite of all preventive measures these symptoms will appear every year, the best way is to destroy completely all colonies affected and to form other groups in other parts of the garden with bulbs coming from places where the disease does not exist. So we formed again very fine groups which, so far, remain quite healthy. The following varieties and forms remained always inferior to our old country type: *cernuum*, *plenum*, "Salo. ika Form," "Sambac Form."

L. carniolicum Bernhardi ex Koch—2 colonies.

L. carniolicum subsp. *albanicum* (Griseb.) Hayek and Markgraf—2 colonies.

L. carniolicum forma *Jankae*—2 colonies. As they are essentially

alpine, these Lilies showed a very capricious growth in our borders. We are now trying to cultivate them in sloping parts of our rock-garden, giving them the protection of a sheet of glass during the winter.

L. Catesbaei Walter—3 series of pots. We have here a Lily difficult to grow in our garden. Even in pots and under glass we cannot succeed in making it happy. It may be that it wants more heat during the winter to be kept in better health.

L. cernuum Komarov—5 colonies. This grows and flowers well, but, like *L. pumilum*, its bulbs are of short duration and it has to be sown every year.

L. chalcedonicum Linnaeus—2 colonies.

L. chalcedonicum var. *maculatum*—2 colonies. This species and its variety took some time to be acclimatized, but now they form fine colonies giving promise of better and better flowering every year.

L. columbianum Hanson—4 lots.

L. columbianum var. *Ingramii*—1 lot. We have not tried yet to grow this Lily and its variety in the open border, but we shall do it this year, as the cultivation in pots does not give good results.

L. concolor Salisbury—3 colonies.

L. concolor "Dropmore"—3 colonies.

L. concolor var. *grandiflorum*.

L. concolor var. *pulchellum* (Fischer) Regel—6 colonies.

L. concolor var. *pulchellum* f. *coridion* (Sieb. and Vriese) E. H. Wilson—3 colonies.

L. concolor var. *pulchellum* f. *okihime*.

L. concolor × "Red Star." *L. concolor*, its forms and varieties, were quickly acclimatized in our garden, but as the bulbs have a short life here sowing will probably be the best means of multiplying them at the "Jardin d'essais."

L. × "Coolhurst Hybrid." This fine hybrid is very strong and multiplying.

L. cordatum (Thunb.) Koidzumi—2 colonies.

As this Lily has the same constitution as *L. giganteum*, the growing is thwarted only by slugs, which are very fond of its leaves.

L. × "Crimson Queen." We did not succeed in keeping this Lily at the "Jardin d'essais," where, after having flowered very well, it quickly disappeared completely.

L. × "Crow's Hybrid." This hybrid is rather more resisting than *L. × sulphureale*, which is one of its parents and is fairly strong in our grounds.

L. × Dalhansonii. This hybrid is very strong in our garden. Last year it gave one stalk strongly fasciated, 4 feet 4 inches high, with a head of about 200 flowers full-blown.

L. dauricum Ker-Gawler—3 colonies.

L. dauricum brenchleyense.

L. dauricum var. *luteum*—3 colonies.

L. dauricum f. *pardinum* (T. Moore) E. H. Wilson—3 colonies.

L. dauricum var. *praecox*.

L. dauricum var. *venustum* f. *Batemanniae* E. H. Wilson—3 colonies.

L. dauricum var. *venustum* f. *macranthum*.

L. dauricum var. *Wallacei* (Wallace) E. H. Wilson—2 colonies.

L. dauricum *Wadai*—2 colonies.

L. dauricum *Wilsonii multiflorum*. All these varieties and forms are strong and of easy cultivation.

Lilium Davidi Duchartre—2 colonies.

L. Davidi f. *macranthum* Raffill. These two Lilies have the same constitution as *L. Willmottiae*, but are more prolific. Both show a tendency to change place.

L. × Davmottiae. Same constitution as *L. Willmottiae*.

L. distichum Nakai. Here this species is delicate and does not multiply much, fearing the drought in summer and the dampness in winter.

L. Duchartrei Franchet.

L. Duchartrei var. *Farreri* (Turrill) K. Krause—2 colonies.

L. Duchartrei f. *lankongense* (Franch.) K. Krause. We lost the first bulbs of this Lily, which we received under the name *L. Duchartrei*, but the other three colonies of *L. Farreri* and the var. *lankongense* are going on all right. As new bulbs are always showing their presence far from the parent plant, it is necessary to reserve rather a big place for the cultivation of those Lilies in order that they could acclimatize everywhere in a soil specially prepared for their needs.

Lilium × *elegans*, "Alice Wilson," *alutaceum*, *atrosanguineum*—2 colonies, *atrosanguineum* f. *rubrotinctum*, *bicolor*, "Diadem"—2 colonies, "Early Dazzler," "Extra Red," *flore-pleno*, "Mahogany," *marmoratum* f. *aureum*, "Orange," "Orange Queen"—2 colonies, *pictum grandiflorum*, "Princess," "Red Emperor," *sanguineum*, *splendens*, "Van Houttei." We have eliminated from our collection a number of others because they were rather inferior to these enumerated. They are all forming strong clumps and are very easily grown.

L. formosanum Wallace—2 lots. *L. formosanum*, Price's var.—2 lots. We cultivate these two Lilies in pots and, as they seem to be very robust, we tried the second one on the open ground, in a well protected part of the garden. Our experiments are too recent to give us convincing results.

L. giganteum Wallich—6 colonies. *L. giganteum* var. *yunnanense* Leichtlin. The cultivation of these two Lilies will not afford any difficulty when we are able to keep away the hosts of slugs which come from the neighbourhood and graze the young leaves to the principal nerves, hindering the development of plants and bulbs. Notwithstanding the havoc played by these terrible pests new bulbs appear every year showing that our colonies have every prospect of increasing rapidly.

L. Grayi S. Watson—2 colonies. Very slow to acclimatize, the plants are now becoming more and more vigorous every year.

L. Hansoni Leichtlin—2 colonies. This species is particularly

vigorous and floriferous in our garden and gives stalks of 6 feet high. No special care seems necessary to succeed. This species, not much known in Belgium yet, has a big future in our country.

L. Heldreichii Freyn—2 colonies. Although this Lily is very near *L. chalcedonicum* it is less vigorous and acclimatizes much more slowly. As it is an alpine Lily we try now to grow it on a gritty slope with perfect drainage.

L. Henryi Baker—3 colonies. This Lily, particularly strong, multiplies rapidly and succeeds well in various situations.

L. Humboldtii Roezl—3 lots.

L. Humboldtii var. *Bloomerianum*—2 lots. *L. Humboldtii* var. *magnificum*—2 lots. Until now we cultivated these Lilies in pots, but this year we try to grow them in a sunny border. The variety *magnificum* is particularly strong.

L. japonicum Thunberg—3 lots. *L. japonicum* var. *rubrum magnificum*. These two Lilies did not succeed well in pots under glass. This year we shall grow them in the open, in a well protected border.

L. Kelloggii Purdy—2 lots. As cultivation in pots does not give us good results we try now to grow it in the open.

L. x "Kulshan." Rather slow to acclimatize, this Lily becomes fairly vigorous afterwards.

L. Leichtlinii Hooker fil. var. *Maximowiczii* (Regel) Baker—4 colonies. var. *Maximowiczii* f. *grandiflora*. var. *Maximowiczii Wadai*—2 colonies. The type is difficult to grow and the bulbs disappear rather soon, even in pots. On the contrary, the variety *Maximowiczii* and its forms thrive in the open and flower abundantly.

L. leucanthum var. *chloraster* (Baker) E. H. Wils.—3 lots. We cultivate this Lily under a glass frame without heat, but it seems it will succeed better in a conservatory during the winter.

L. longiflorum vars. *albo-marginatum* T. Moore; *eximium* (Courtois) Baker—3 lots; *insulare* Mallett—3 lots; *multiflorum*; *nobile* E. H. Wilson—2 lots; *takesima* Duchartre—2 lots. With the exception of the variety *albo-marginatum*, which keeps badly, this Lily multiplies rapidly. Cultivation in pots suits it very well and it flowers there splendidly. During the winter we keep it under glass frames without heat, which we cover with straw mats when the cold is too bitter. The variety *insulare* is the most multiplying of all.

L. x "Marhan," "Ellen Willmott," "G. F. Wilson," "H. J. Elwes." These hybrids grow irregularly and give some vigorous plants as in the variety "Ellen Willmott," where we got stalks 6 feet high, while other plants remained very weak and did not give any flowers, although all the conditions were the same.

L. maritimum Kellogg. Very difficult to keep; even in pots we did not succeed to keep it in life.

L. Martagon Linnaeus—2 colonies; *album*—3 colonies; *albiflorum*; *albiflorum* f. *superbum*; *Catianae*; *dalmaticum*. A robust species fairly common in our gardens, although it is not always very floriferous.

The varieties *album*, *albiflorum* and *albiflorum* f. *superbum* are much more delicate and disappear easily. The varieties *Cattaniae* and *dalmaticum*, on the contrary, are very strong and easy to cultivate.

Lilium × "Maxwill." This hybrid has the same constitution as *L. Leichlinii* and flowers abundantly every year.

L. medeoloides A. Gray—3 colonies. Not too strong a species, not growing well. We try it in a spot more protected against the sun.

L. Michauxii Poiret—2 colonies. The plants are vigorous and multiplying. They seem to be at least as hardy as *L. pardalinum* and *L. superbum*.

L. michiganense Farwell—2 colonies. Until now the plants are less vigorous than its neighbour species, *L. canadense* and *L. superbum*. It may be that with time they will become just as strong.

L. monadelphum Marsch. Bieberstein—2 colonies. This Lily, which is said to be strong and easy to cultivate, has not given us good results yet; it withers and does not seem to acclimatize. Perhaps the bulbs received were too fat and prone to decay and to fall a prey of vermin.

L. myriophyllum Franchet and var. *superbum* (Baker) E. H. Wilson—3 lots. These two Lilies are grown in pots and under cold glass frames. The wintering in a glasshouse would certainly suit them better.

L. neilgherrense Wight. We grow this in pots and under a cold glass frame, where it does not go well. It seems that it would succeed better in a glasshouse.

L. nepalense D. Don—2 lots. The same remarks as for *L. neilgherrense*.

L. nobilissimum (Makino) Makino—2 lots. Same remarks as for *L. leucanthum* var. *chloraster*.

L. occidentale Purdy. Although we have taken the greatest care with this Lily, the species disappeared less than one year after planting. Yet, as it is said to be easier to grow than its neighbour, *L. marilandicum*, we shall try again in another place in the garden.

L. ochraceum Franchet—3 lots. Same remarks as for *L. neilgherrense*.

L. × pardaboldii and "Dimsdale's variety." These Lilies acclimatize rather slowly, but afterwards they become fairly strong.

L. pardalinum Kellogg; var. *angustifolium*; var. *californicum*; var. *giganteum*; var. *Johnsonii*; var. *pallidifolium*. These species and varieties are vigorous and easy to grow, but are sometimes slow to become acclimatized.

L. Parryi S. Watson—3 colonies. We did not succeed in getting good results with this Lily. This may be due to the fact that the Belgian climate is rather capricious, while in its native country the seasons are quite distinct and more constant.

L. parvum Kellogg—2 colonies; var. *luteum* Purdy—2 colonies.

These two Lilies, natives of the high Californian mountains, will always be rather difficult to grow in our garden, on account of the inconstancy of our climate in all seasons. Nevertheless, the results we get with these Lilies seem to prove that they are somewhat more easy than *L. Parryi*.

L. × "Philada." With us this Lily did not resist and seems to be too delicate to be grown in the open.

L. philadelphicum Linnaeus—3 lots; var. *andinum* (Nuttall) Ker-Gawler—2 lots. These Lilies, kept in pots, grow somehow. We are now trying to cultivate them in the open, in a spot where we could protect them during the winter against an excess of dampness.

L. × phildauricum. This hybrid of the same parents as *L. × "Philada"* did not succeed better when cultivated in the open.

L. philippinense Baker—2 lots. Same remarks as for *L. leucanthum* var. *chloraster*.

L. polyphyllum Royle—2 lots. Same remarks as for *L. leucanthum* var. *chloraster*.

L. pomponium Linnaeus—3 colonies. Of our three colonies, we kept only one in life, in a sheltered part of the garden, where the soil had been deeply worked. We shall make use of that accidental information when we establish new colonies of this pretty species.

L. × princeps E. H. Wilson—2 colonies. "G. C. Creelman"; "Pride of Charlotte"; "Shelburne hybrid." The variety "G. C. Creelman" is stronger and more floriferous than our old stock of *L. × princeps*. "Pride of Charlotte" and "Shelburn hybrid" have not been in our garden for long time enough to allow us to make any comparison.

L. pumilum De Candolle—5 colonies and "Golden Gleam." These two Lilies are easy to grow, but as the bulbs are of short duration they must be increased by seeds.

L. pyrenaicum Gouan—2 colonies, and var. *rubrum*—2 colonies. This species and its variety are particularly strong in our garden, where they grow and flower abundantly without any special care.

L. regale E. H. Wilson—2 colonies. Strong and easy to grow, this species is now very popular in Belgium. It can be increased with the utmost easiness by seeds or bulblets.

* *L. Roezlii* Regel—2 colonies; *L. Roezlii* var. *rubrum*—2 colonies. Rather slow to become acclimatized, these two Lilies become strong afterwards.

L. rubellum Baker. Planted in a well-sheltered place, this Lily seems hardy enough to stand our winters under a covering of peat and boughs of fir.

L. rubescens S. Watson—4 lots. Same remarks as for *L. philadelphicum*.

L. × "St. Nicholas." Of same parentage as *L. × "Marhan,"* *L. × "St. Nicholas"* flowers much more regularly than the first, "Marhan," and gives yearly flowering stalks of about 4 feet high.

L. Sargentiae E. H. Wilson—2 colonies. This species, very near *L. regale*, is much less vigorous and our two colonies do not increase much.

L. × Scottiae—2 colonies. Same constitution as *L. Willmottiae*, but not so strong.

L. speciosum Thunberg; f. *album-novum*, Mallett; var. *cruentum* *Schrijmakersii*; var. *gloriosoides* Baker; f. *Kraetzeri* Duchartre; var. *magnificum*—4 colonies; f. "Melpomène"; f. *punctatum* Courtois; f. *roseum* Masters; var. *rubrum* Masters. We succeed very irregularly with this Lily and all its varieties. We kept as being the most vigorous and prolific varieties and forms:—f. *typicum*, f. *album-novum*, f. *Kraetzeri* and var. *magnificum*.

L. × sulphureale—4 colonies. This hybrid, whose four colonies held out very well in the open until the end of the summer 1936, grew much less well last summer, we suppose on account of the cold weather of the spring of 1937.

L. si perbum Linnaeus. Species strong and easy to grow, but slow to become acclimatized.

L. sutchuenense Franchet. Same constitution as *L. Willmottiae*.

L. Szczecianum Fischer and Av. Lallement—6 colonies. Although this Lily is very near *L. philadelphicum*, it is with great difficulty that we could succeed to get two good colonies whose bulbs begin to take some strength. We suppose that our first failure are due to the fact that we used too fat bulbs, probably already fatigued by the journey and therefore an easy prey to rot and vermin.

L. × testaceum Lindley—2 colonies. Like *L. chalcedonicum*, one of its parents, this fine hybrid was slow to become acclimatized but is now vigorous and flowers regularly.

L. tigrinum Ker-Gawler—2 colonies; var. *flore-pleno* Regel—2 colonies; var. *Fortunei* Standish—2 colonies; var. *splendens* Leichtlin—3 colonies; var. *splendens* f. *burnhamii*. This Lily, vigorous and very easy to grow, is very common in Belgian gardens. With us they had always been very strong till the spring 1937, when some colonies, especially one of var. *Fortunei*, imported from Japan in 1935, suddenly partly decayed when some stalks were already 12 to 15 inches high. When dug up the bulbs of the diseased plants proved to be attacked by rot.

L. tsingtaense Gilg—3 colonies. This species does not flower much here and is rather weak. It seems to fear drought in summer and dampness in winter.

L. umbellatum var. *erectum*; "Golden Fleece" 2 colonies; var. *grandiflorum*; var. *incomparabile*—3 colonies; "Invincible"; "Monarch"; "Orange Brilliant"; "Orange King"; "Refulgence"; var. *splendidum*; "Thalia"; "Vermillion Brilliant." *L. umbellatum* is very common in Belgian gardens. Of the varieties enumerated we eliminate some as being inferior to others. They form very strong and multiplying clumps and are very easy to grow.

L. Wallichianum Schultes f. Same remarks as for *L. neilgherrense*.

L. Wardii Stapf. Of the same constitution as *L. Duchartrei* and its varieties, this Lily wants the same treatment and a prepared place sufficiently large in order that it could spread in good conditions.

L. Washingtonianum Kellogg; *L. Washingtonianum* var. *purpureum* Purdy, non Baker. Same remarks as for *L. philadelphicum*.

L. Willmottiae E. H. Wilson. Vigorous species easy to grow but increasing slowly, perhaps because it exhausts itself in flowering.

We have in cultivation some other kinds and varieties of Lilies, but we have not had them long enough to allow them to take a place in a list of Lilies carefully observed.

LILY-GROWING IN NEW ZEALAND.

By B. W. DOAK, Palmerston North, N.Z.

IT is impossible to generalize regarding the conditions under which the New Zealand Lily enthusiast attempts to grow his lovely plants. A consideration of the geographical position of this country will show how greatly climatic conditions are likely to vary. New Zealand extends roughly 1,000 miles in length, with the northern-most portion approaching the Tropics. This northernmost portion enjoys a sub-tropical climate where frosts are almost unknown, whereas in the South Island frosts of up to 20 degrees are not uncommon. Both the main islands are divided longitudinally by mountain ranges which greatly modify the climate. On the western side of the ranges the annual rainfall is considerably higher than on the eastern side, and the climate generally milder. The dry eastern districts are subject to heavier frosts. The rainfall throughout the country varies from 20 to 100 inches per annum, the greater part of which falls during the winter months. Frosts do very little damage even where 20 degrees or more are experienced. This is due to the fact that the ground does not remain frozen from day to day, but even in a cold spell thaws out to a certain extent during the hours of sunshine. Occasionally a late spring frost will damage the young shoots of *Lilium regale*, but a reputedly tender species such as *L. myriophyllum superbum* can be grown outside throughout the country.

The wet conditions during the winter and early spring constitute the greatest difficulty with which the Lily grower in New Zealand has to contend, more failures being due to this than to any other cause. Botrytis and basal rot also take their toll, though this latter trouble is no doubt accentuated by the excessive winter moisture and insufficient drainage. Considering the difficulties and problems which confront the enthusiast in this country the range of species, varieties and hybrids which are grown—more or less successfully—is surprising. In the first place the New Zealand amateur, unlike his English fellow gardener, has no opportunity of seeing and becoming familiar with any new species or variety, before attempting to grow it. All he has to guide him is the reports on the plant's behaviour in the possibly very different conditions of another country. This is in itself a handicap, but to this handicap is added the greater primary difficulty of successful importation from the Northern Hemisphere, and the subsequent acclimatizing of the bulbs. The trouble associated with passage through the tropics can be largely minimized by the rather costly transport in ship's vegetable chambers,

but the acclimatization of the plants, involving a reversal of the growth periods, is by no means easy. Our seasons are diametrically opposite to those in the Northern Hemisphere at any given time. However, this same difficulty of importing has to a certain extent proved a blessing, especially with species, as many enthusiasts have been forced to raise their bulbs from seed, with the result that their stock is frequently more vigorous than that which has been vegetatively propagated.

In a country with so many diverse conditions as exist in New Zealand it is not surprising that the really *ideal* conditions for some Lilies are found in some districts. For example, there are several places where *L. giganteum* reproduces itself seminally, without any assistance, and in such places is becoming naturalized. The European, Chinese and Tibetan species, in general, are comparatively easy to establish, but Japanese and American Lilies as a whole must be regarded as being definitely difficult. It is quite an achievement to grow and flower such Lilies as *L. japonicum*, *L. rubellum*, *L. nobilissimum*, *L. Parryi*, *L. Washingtonianum*, etc. The American species raised from seed are undoubtedly much more amenable than imported bulbs. Once this fact is more generally recognized there is little doubt that the cultivation of these species will receive a decided impetus. The Japanese *L. rubellum* and *L. japonicum* present a greater problem, for imported seed of these are often not viable by the time it reaches here. Until enthusiasts can obtain locally saved seed it is unlikely that much success will be experienced with these species. *L. auratum* is in the difficult class, though the variety *platyphyllum* is frequently seen. The reputedly delicate variety known here as *rubro-vittatum*, but which is probably really var. Crimson Queen, appears to have a better constitution than the type—at least I can myself grow the variety successfully, though I fail with the type.

Provided that the new spring growths can receive some protection from low-growing subjects, practically all species are hardy throughout the greater part of both islands. Such species as *L. ochraceum Lowii* are quite hardy in the southern part of the North Island, and probably in most parts of the South Island. *L. neilgherrense* is also hardy in the North Island, but is rather difficult to flower. Especially in loose soils the stoloniferous species are very apt to produce numerous bulbils and few flowers. This is the case with *L. Duchartrei (Farreri)*, *L. Davidi* (in some soils), *L. neilgherrense*, *L. nepalense*, and *L. ochraceum* (in some soils).

It would be inconvenient in a article such as this to deal with each species, variety, or hybrid that is grown in New Zealand, as several amateurs grow seventy different Lilies, while one or two have collections of ninety or one hundred. Of the rarer species, some such as *L. leucanthum centifolium*, *L. Wardii*, *L. ochraceum*, and *L. Brownii* are rare because of comparatively recent introduction, rather than because they have proved difficult to establish, but others are rare because of difficulties associated with their cultivation. Into this latter class

fall some of the Western Americans, and most of the Japanese Lilies.

This article would not be complete without some reference to hybrid Lilies. Considerable interest is being taken in these, and several hybrids showing some promise have been raised. Overseas-raised hybrids such as those of the late Dr. GRIFFITHS, Mr. SKINNER and Miss PRESTON, are being favourably received by enthusiasts over here. Whether these hybrids will stand the test of time remains to be seen, though if their present vigour can be maintained they should do well. An Australian raised variety, *L. speciosum* var. *Gilreyi*, has been very successful so far. This is undoubtedly the best form of *speciosum* ever seen here. It has the colour of "Melpomene" with extraordinary width and substance of petal.

Any species or hybrid which will travel through the tropics without the assistance of cool storage, start into growth at its normal Northern Hemisphere time and grow continuously through our winter without much protection must be, according to my ideas, a very vigorous Lily. Several of the newer hybrids have done this, though few species have done so. Outstanding in this respect were Mr. SKINNER's fine hybrids \times *Scottiae* and \times *Philras*. The former is very distinct in colour (salmon apricot) and in its way of holding its flowers so that they look at one. *L. \times Philras* is a fine orange Lily of the Eulirion class. These two hybrids settled down particularly well and have increased rapidly. Certain of Dr. GRIFFITH's hybrids have settled down fairly well with me, but they were more difficult to acclimatize. *L. \times Kulshan* and *L. \times Sacajawea* have proved to be the most vigorous of the *pardalinum* \times *Humboldti* hybrids tried here. *L. \times G. C. Creelman* and selected forms of Crow's hybrids as well as *L. \times Davmottiae* also give promise of exceptional vigour. Those hybrids that have proved themselves of being worthy of garden room by having some quality which makes them in some respect superior to their parents, are all the result of vigorous selection from a fairly large number of seedlings. In this country I fear that just because a plant is of hybrid origin it is considered to be worthy of introduction. As in other countries, indiscriminate crossing of Lilies is to be deprecated.

There has been an increasing interest taken in the cultivation of Lilies of recent years, but in spite of this well-grown clumps of Lilies are few and far between. It may be hoped that the position will be rather different in the future. We have many natural conditions in our favour. To instance only two—rodents do not trouble our bulbs, and our climate is particularly favourable for seed production.

As I write this article (September 1) the earlier Lilies are beginning to show above the ground after the most favourable winter conditions we have experienced for many years, and enthusiasts are looking forward with more confidence than usual to a very favourable Lily season.

LILIES IN THE NORTH-EAST OF SCOTLAND.

By MRS. TENNANT of Innes.

BEFORE writing this article I read again that written by the late Sir HERBERT MAXWELL on Lilies in Scottish gardens in the Lily Year-Book of 1932.

Sir HERBERT lived in the south-west, whereas here we are on the north-east coast, one and a half miles from the sea. Directly across the ocean lies the North Pole, whence come the bitter cold winds that we yearly experience during the months of April and May. On the credit side we have a light sandy soil, apparently well suited to the cultivation of all bulbs because of its perfect drainage. We can grow the following Lilies which Sir HERBERT tells us failed in his garden, *L. rubellum*, *L. Washingtonianum*, *L. Parryi* and *L. Brownii*.

Another factor which may enable us to grow Lilies fairly well is the comparatively small annual rainfall of 28 inches, which lessens the danger of bulbs rotting off during the winter. Here, where the summer sun is less strong than further south we can plant the following shade-loving Lilies in full sun, *L. giganteum*, *L. rubellum*, and various American species.

L. leucanthum centifolium has been found difficult to establish, perhaps because we made the mistake of planting our small bulbs as soon as they were received.

L. Grayi has been a failure. *L. speciosum* and its varieties are not much good in this district, as they flower too late, with the exception of the variety *punctatum*, which I hope is going to do well as it blooms three weeks earlier than the type; we have not yet had it long enough to know with any degree of certainty that it is going to flourish.

L. myriophyllum superbum was planted three years ago, since when all the bulbs with one exception have died off. This one continues to bloom every year, and what is more interesting it appears to flower a little earlier each season and is now at its best by the middle of September.

L. × testaceum blooms magnificently, and of the newer hybrids 'G. C. Creelman' is superb, to my mind far superior to *L. regale*, being much less susceptible to frost; this year we lost only one bulb out of some sixty.

L. × Maxwill is also a first-rate garden Lily, possessing every virtue, well-balanced flowers set on a stiff wiry stem, and a perfect constitution.

L. × Scottiae is another excellent hybrid which thrives well, as it blooms early and its thick strong petals pay no heed to the cold winds of spring.

L. auratum is good in either full sun or shade. *L. japonicum* in its various forms always seems happy in our light soil. *L. chalcedonicum* and the variety *maculatum* do well, but *L. candidum* is all too subject to disease.

Of the American Lilies *L. superbum* grows to about eight feet, *L. pardaligum*, *L. Parryi* and *L. Roezlii* all thrive. *L. pardalinum giganteum* certainly seems to be stronger than any other form. Colonel NAPIER's variety of *L. Davidi* is in this locality superior to the type.

L. Henryi must be classed as a failure, the stem is strong enough, but nothing seems to make it grow upright and the flowers are small. It is, however, good for cutting and lasts well in water.

Here at Innes, with our good drainage and neutral soil, it would seem possible to grow almost any Lily that is not too tender.

LILIES IN AUSTRALIA.

By GILBERT ERREY, Victoria, Australia.

SOME mention has been made about Lily Bulbs lying dormant for a season. I can report that here, in a valley of heavy loam, the species *longiflorum* frequently lies low entirely—rows of several hundreds of bulbs well established showing neither signs of growth nor decay. Once only have I noted the same dormancy of an entire planting in light volcanic soil at an altitude of 2,250 ft. And one year three separate plantings of a seedling *speciosum* failed to appear above ground here—one lot being where the sun shone for only two hours daily in mid-summer and another lot being in full sun for over twelve hours daily at the same season. Yet all appeared at the normal time the season following, and in many years the strange inaction has not been repeated.

Reverting again to *L. longiflorum*, last December I saved twelve stems which had done duty indoors as floral decorations—placed them slantwise in loose soil in the open ground, covering about 12 inches of stem and leaving 9 or 10 inches above the soil. On July 1, 1938, these stems were lifted bodily, and most of them had formed young bulbs at the leaf joints. The largest of the young fry was $\frac{3}{4}$ in. diam., but the majority would be from $\frac{1}{2}$ in. to $\frac{1}{4}$ in. These have been planted out to note future growth.

It is interesting to read in a Year-Book that a wet winter is credited with being conducive to a good following season amongst the Lilies. Perhaps our mean rainfall of 35 in. (approx.) is greater than the normal in English gardens, but here the drier the winter the better growth the following season. Victoria has her greater moisture in the months of late spring—our November rains at times measure to twelve inches, while in September or October a six inch measuring is not abnormal. Fairly heavy losses through basal rot is not surprising in this fairly heavy soil, but even in the rapidly drained soils of the steeper mountain hillsides the rhizomatous American Lilies suffer heavy losses through the same cause. Bulbs grown locally from seeds are no more immune from this winter weakness than are bulbs recently introduced, and of late years my custom has been to cover completely the beds containing *L. Parryi*, *L. canadense*, and any of the *Humboldtii* hybrids excepting the one known here as *L. × pardaboldtii*. The European *L. croceum* and the Asiatic *L. Bakerianum* also seem to appreciate a very limited supply of moisture from leaf-fading to the spring growth period. Three Lilies which have very early leaf growth (*L. candidum*, *L. longiflorum* and *speciosum* 'Pearl') each of which is in good

foliage when the Snowdrops open their bells, also wear a more healthy sheen after a dry winter, and it is scarcely necessary to add that a moderately dry spring lessens the toll of the leaf Botrytis.

In one Year-Book I read of a grower having success with *L. pardalinum* planted 2 ft. below the surface. As for many years my best results with this Lily have come through shallow planting and annual dividing, I feel so anxious to test the depth theory that I have made a new bed where *L. pardalinum* has been planted 12 in. deep in very well drained soil, and a second smaller bed planted 24 in. deep. At both beds I have erected prominent name labels in full anticipation that a tombstone record is called for! The self-scattered seeds of *L. pardalinum* germinate freely, and in sheltered spots by permanent plants such as Agapanthus the seedlings speedily form new clumps. Raised from seeds sown in open ground a few species will flower the second season; *L. Henryi* has been flowered in 20 months from seed sowing, but, of course, under glass both *L. regale* and *L. philippinense* will flower in their first season of growth.

L. ochraceum burmanicum here reaches to 6 ft. in height and is a most reliable garden Lily unless it becomes waterlogged. It is free-flowering in full sun, and also forms small offsets below the surface.

To test the theory that *L. Wardii* is strongly averse to lime, I last season planted a few bulbs in soil heavily dressed with ground limestone and its height of stem and number of flowers varied not at all from those grown in a lime-free bed. The second year of growth may tell a different story.

Concerning Nomocharis, the few which I have grown have been on a bank of hard, somewhat clayey loam, and for three years they have increased in stature yearly, making bulbs to 1½ inch diameter and best stems to 27 inches tall. Their growth really is remarkable, being brought to the flower-opening stage within twenty-five days of the shoot breaking ground. That this tropical growth is "exceeding tender" was proved to me the past season when a shade temperature about 100° Fah. completely killed a fine specimen growing in full sun. Nomocharis seed freely here and also grow freely from scales in open ground. Seeing in the "Gard Chron." an offer of seeds freshly gathered in England, I sent per air mail to Messrs. CONSTABLE for some, and in just 54 days from despatch of my letter I had three of the young fry showing through the open ground seed row.

Large bulbs of *L. lankongense* here are not stoloniferous, but all bulbs under an inch in diameter wander underground almost as freely as does *L. nepalense*. This stoloniferous habit of immaturity is also strong in seedlings from the 5 ft. tall *L. croceum* crossed with the dwarf forms of *L. elegans*, and here also the adult bulbs show always an erect stem habit.

GERMINATION OF LILY SEED.

By E. O. CLEMENT, Penetanguishene, Ontario.

YOUR Secretary has been good enough to request some notes on germination of Lily seed at Penetanguishene, Ontario, and I am very happy to describe some of my experiences. Meteorological conditions here are about the same as at Ottawa, where your correspondent, Miss ISABELLA PRESTON of the Central Experimental Farm, is carrying on valuable work in hybridization of Lilies. We have a good snow cover which usually remains from December to mid-March. Temperatures will range from a winter low of 30 degrees below zero Fahrenheit (i.e. 62 degrees of frost) to a summer high of 100 degrees Fahrenheit. All our Lily-growing operations are carried out under outdoor conditions.

For a couple of years I was sowing Lily seeds indoors in late winter. I would prepare the seed flats and then do the actual planting in the evening. The resulting percentage of germination was almost nil. Then I turned to more natural conditions. In late October of 1935 I planted seeds of *L. 'Maxwill'*, *L. concolor*, *L. regale*, '*G. C. Creelman*' and *sulphurea* × *princeps* (Crow hybrids) in five open-top garden frames. When the ground became frozen I mulched them with coarse material. In the following spring, when the weather became settled, I removed the mulch and placed slatted covers over the frames. These lots of seed germinated nearly 100 per cent. and made fine bulblets at the end of the first season. In their second season I had a scattering of blooms among the bulbs of '*Maxwill*' and *concolor* I had left in the frames for the two years, as well as among others of these two varieties I had transplanted to nursery rows at the end of their first season. In the autumn of 1936 I again planted a number of outdoor frames. The winter was abnormally mild and wet and germination in the spring was scanty.

From certain unusual experiences of correspondents with Lily seeds and from reading of tests with lettuce seed and other experiments, I was led to believe that the important factor in germination of Lily seed was exposure to the sun's ultra-violet rays. In the R.H.S. Lily Year-Book of 1936 Mr. ARTHUR GROVE tells of the Effect of Frost on Lily Seeds. My opinion is that it was exposure to light that hastened germination. Frost of 12 degrees would surely have affected the balance of the seed that was covered only one-half inch.

During the course of some experiments in Germany, a nest of hen's eggs was exposed to ultra-violet rays for several days, morning and evening. The chickens hatched before their time and were very vigorous. Now a fertile Lily seed is essentially the same as a fertile hen's egg. The germ of life is there, and food for the young plant until it can establish its own root system.

If exposure of the seeds to the ultra-violet rays is really the factor that hastens the biological processes and ensures strong germination then we shall, probably find here that planting seeds in outdoor frames in late March or early April will give best results. All who plant Lily seed should keep full and careful records of all stages of their work. With this early spring sowing the seeds will have some exposure to spring frost and if they are planted shallow and given some exposure to direct sunlight before covering, I think we can get a high percentage of germination.

I make no claims to being a scientist, and only proceed empirically. In any future operations I shall take more care in keeping a record of meteorological conditions, time of day when planting, and any other factors that may have any influence. Prof. E. F. PALMER, Head of the Department of Horticulture of the Ontario Agricultural College, also believes the effect of light is to activate the germ. He is supervising germination tests with Lily seeds along scientific lines against light control, and the results will probably be given out in due course. If Professor PALMER'S tests prove to be of especial importance to Lily growers I shall see that your Society is apprised of his findings when he sees fit to make them public.

My special interest in Lily seedlings is in the *L. regale* derivatives, as I believe them to hold the greatest promise. We have re-crossed selected *sulphurea* × *princeps* with pollen of *L. regale*, and hope for added hybrid vigour with more of regale's glowing colour as well as an extended blooming season. It may also be possible to select more racemose forms. There is no limit to what may be accomplished in plant breeding, and amateurs may have a share in this fascinating pursuit.

There is a lack of recorded experience in regard to longevity of Lily seed. On April 12 of this year I tried out three lots of seed of *L. regale* of the years 1935, 1936 and 1937, the three lots of seed being planted in one seed frame under identical conditions. After six weeks the seeds of 1936 and 1937 performed equally well, both lots showing germination of about 80 per cent., but the 1935 seed was almost worthless, germinating only 8 per cent.

My theory as to the effect of light on germination of Lily seed may not be taken seriously by your members, but I think it has interesting possibilities. I have been trying to work out a technique of growing Lilies from seed, and am now convinced that fresh seed sown about November 1 or just before freeze-up gives best all round results. Germination in spring is early and of a high percentage. The first year bulblets are better matured by fall and go through their first winter with but slight mortality. Bulblets from spring seeding do not winter nearly so well outdoors. These results apply especially to the *regale* hybrids which are not as easy to germinate as the type.

I hope my rambling notes may at least stimulate some interesting discussion of an important phase of Lily growing.

ORIGIN OF LILIUM X T. A. HAVEMEYER.

By TOM BARRY, Lambertville, N. J.

I THINK it necessary to enlarge a little on the title to explain some of the results.

For a number of years I had been raising and crossing Lilies and had a collection of plants in my yard for breeding purposes that were true to type, but were the result of several crosses.

In 1933 I got the idea if I could get tiger breeding into some other Lilies they might develop extra hardiness, so I used tiger pollen on everything I had and about ten varieties on tiger.

When a seed pod formed on *L. myriophyllum superbum* I began to hope I had something, as it was the first I had been able to get on this species. However, it failed to develop properly and was not ripe at freezing time, so I dug the whole plant and let it ripen in the greenhouse of a friend.

There were few seeds, and they were light in weight, more like bran than something that would grow.

However, Dr. MCLEAN of the N.Y. Botanical Garden, was interested in this cross, and I gave him a few seeds. Mine I planted in my sash house in March. The seedlings came up quickly about the same as *L. regale*, but made more growth and were planted outside in May.

The following year I could see I had a new type of foliage, and when a number of them flowered they were all alike and evidently a good new Lily. Dr. MCLEAN had raised one and that was identical with mine. But the thing that surprised me most was that they showed a number of characteristics of *L. Henryi*; only a stiffer stem and broader foliage and with the exception of some stem bulbils nothing of *myriophyllum superbum* or Tiger.

I propagated it from scales and stem bulbils, and crossed it back on itself hoping it would breed true. About 25 second generation plants flowered this year ('37), all different, and I think good, new Lilies showing characteristics of Sulphur, Henry and Tiger and setting seed with a dozen other varieties.

It may be of interest to say that of all the other crosses there were no good breaks; a few Regal crosses made stem bulbils, the Tiger seedlings came in various seasons and size of flower, but still pretty much Tiger. One Henry pod gave me some variation in colour from light yellow to orange.

LILY GROUP TOUR OF GARDENS.

EACH year the Lily Committee arranges for members of the Lily Group to visit some gardens in which Lilies are a prominent feature. In 1938 the tour was planned for Saturday, July 2, which turned out to be a sunny but not unduly hot day. At 10.45 a.m. about fifty members assembled at Borde Hill, Sussex, where they were received by the owner, Colonel STEPHENSON R. CLARKE, who very kindly gave up the morning to act as guide. Among the Lilies which were seen in fine form were *L. cernuum*, *L. Davidi*, *L. giganteum*, *L. Hansonii*, *L. Martagon*, *L. Martagon album*, *L. × 'Maxwill'*, *L. monadelphum*, *L. philippinense*, *L. formosanum*, and *L. × testaceum*. There was also a splendid group of *Nomocharis pardanthina* (fig. 20). In addition there was a wealth of uncommon trees and shrubs, including many tender kinds and when, after two hours, the party had to leave in order to keep to its timetable everyone realized that at the end of a day there would have still been much of interest to see.

From Borde Hill the party proceeded to the Felbridge Hotel, East Grinstead, for luncheon, and then on to Ford Manor, Lingfield, Surrey, where they were received by the Hon. Mrs. PAULINE SPENDER CLAY. Here a delightful afternoon was spent under the guidance of the hostess who conducted the party through the very extensive woodland and water-side garden. Ford Manor has a reputation for growing *L. Parryi* to perfection and on this particular day it was just at its best, making a charming picture (fig. 12). But it was by no means the only Lily which was doing well for there were splendid colonies of *L. bulbiferum croceum*, Coolhurst Hybrid and *L. Wardii* as well as good examples of *L. canadense*, *L. × Davmottiae*, *L. giganteum*, *L. × 'Marhan'*, *L. Martagon*, *L. monadelphum* and *L. × testaceum*. Mrs. SPENDER CLAY very kindly entertained the party to tea, and at 5 p.m. the homeward journey was begun to the sound of thunder, which had very obligingly kept off all day, but was now welcome, for it soon brought what most gardens were badly wanting, a good shower. And so ended a most interesting and enjoyable day.

LILY NOTES.

Lilium Washingtonianum minor.—This Lily is found native about the slopes of Mt. Shasta. It resembles the type, but is smaller, spotted, fragrant, and pure white. In the wild, I have never seen it turn colour as does the variety *purpureum*. Six years ago, one plant in my garden after being established for three years, turned light pink. This summer, there are three in bloom now, and one is turning pink, the other two remaining white.—*Dr. Vollmer.*

Lilium Leichtlinii.—The illustration (fig. 33) of *L. Leichtlinii* was taken from a plant which flowered in my nursery at Southborough in the early part of July this year. Another plant with two flowers opened later, and was exhibited at the R.H.S. meeting on July 19. The bulbs were imported from Japan and were brought-on in a greenhouse, but I did not succeed in obtaining an open flower in time for the Lily Show on July 5. The blooms were primrose yellow, copiously spotted with purple-brown or crimson-brown spots. The pale yellow style is capped by a purple stigma. It will be observed that the flower is hardly of the typical Martagon form, but that the segments are much more spreading and less reflexed. In this way they almost resemble the small flowers of *L. auratum*, a resemblance which was noted by Sir JOSEPH HOOKER in his account of the plant in the Botanical Magazine t. 5673. He wrote: "From the prince of the genus, *L. auratum*, which in some respects it approaches, it (*L. Leichtlinii*) differs both in the colour and form of the perianth leaves and in wanting the longer processes on these which *L. auratum* bears."

L. Leichtlinii is certainly very closely related to the early-flowered form of *L. Maximowiczii*, which also has few blooms and is listed by WILSON as *L. Leichtlinii* var. *Maximowiczii*. The late-flowering *L. Maximowiczii*, which blooms in September, appears to be a different variety.

Mr. COTTON, who paid a special visit to Southborough in order to see the specimens, writes as follows:—

"There is no doubt whatever that you have the true *L. Leichtlinii*. Your flower agrees almost exactly with the plate in the Botanical Magazine (t. 5673), which is where the species was first described, and also with the plate in the Monograph by ELWES. The flowers in the Botanical Magazine are rather overcoloured and appear to be cramped into a small plate. Their spreading habit, which HOOKER noted, is much better shown in the larger plate of the Monograph.

"I am not sure, however, if this almost stellate appearance of the flower is normal, and think that well-grown bulbs, if entirely free from virus, might produce large flowers of Martagon shape and perfect in form. If you have any luck as to seed you may be able to raise a more robust stock.

"The early, few-flowered form of *L. Maximowiczii*, of which you sent me a specimen, seems identical with *L. Leichtlinii* except in colour, and I see no reason for not accepting WILSON's view that the latter is in reality only a form in which the red pigment is absent.

"The many-flowered form *L. Maximowiczii* which flowers in September is certainly distinct and appears worthy at least of a varietal name. At present it is best included under this species, as the last word has not by any means been said either about the botany or the nomenclature of the *Maximowiczii* series of Lilies."—W. A. Constable, *The Lily Gardens, Southborough*.

Lilium polyphyllum.—The accompanying photograph (fig. 34) illustrates a plant of *L. polyphyllum* which is generally regarded as a tender and difficult Lily. It is the plant I referred to in a note published in Gard. Chron. Nov. 7, 1936, p. 334. The bulb was one of a consignment received from India about 6 years ago by the Burnham Lily Nursery. It was planted 10 inches deep and well surrounded by sand on a sloping bank in the rock garden in a bed filled with a moraine mixture for about 2 ft. The bank faces east and is exposed to the sun and wind, but it is sheltered at the upper end by trees. The plant has had no protection at all in winter and in spite of several very trying seasons the bulb continues to thrive.

It produced one flower in its second season; three flowers the third and five flowers during the past two years. The colour which began by being very indeterminate has been in these last two seasons a quite definite pink shade just paler than *L. Wardii*. The stem is very erect and strong and the plant is of very good habit. If the colour were a little deeper it would rank high for decorative value. As it is I consider it more interesting than beautiful, but a clump would be quite pretty.

In a later number of The Gardeners' Chronicle (Jan. 9, 1937, p. 23), Mr. GROVE gave his opinion that *L. polyphyllum* is not so tender as is generally thought, but is intolerant of our wet winters. There is more chance of success when raised from seed. The well-being of the single bulb which I planted in my garden is probably to be attributed to the rapid drainage provided by the steeply sloping bank and the moraine mixture in which it was planted.

Mr. COTTON has pointed out to me that, as already stated by FRANCHET and by Sir WILLIAM WRIGHT SMITH, the long green nectary is smooth and devoid of white papillae. There is obviously, therefore, a slip in WILSON's Lilies of Eastern Asia as in his Key the species is

not inserted in the series where the "nectary is naked and glabrous," but in the one with the furrow "margined with crested papillae" (page 15). The same slip also occurs in the description on page 67.

Countess Grey, Howick.

The Bulbs and Seed of Fritillaria.—I have just finished an exhaustive inspection of all the Fritillaries I grow in pots. The bulbs this year look better than I have ever seen them. Their condition is largely due, I believe, to the fact that I have never allowed them to get really dry all summer. They have remained plunged, in their pots, in shingle in the cold house, which, with the sun pouring down on it, should better be described as a hot house. Every week the pots have been given one good soaking of rain-water.

With very few exceptions the bulbs, when knocked out, all looked exceedingly healthy.

I was very much struck by the variations in increase recorded by different species. As a complete contrast I would quote *Fritillaria Raddeana* and *F. latifolia*, both of which I potted up (one bulb of each) in 1934. In four years *F. Raddeana* remains the one bulb, slightly increased in girth, which I planted originally, whereas *F. latifolia* is represented by twelve bulbs, all of which flowered this spring, one bearing two flowering stems. *F. Raddeana*, nevertheless, has yearly set quantities of seed, whilst, on the other hand, *F. latifolia* has never once given me a seed.

The American Fritillaries seem to indulge readily in both methods of increase, and I wonder if that is why, with me at any rate, their flowering capacity is so unreliable. They nearly all set seed in quantity, and at the same time increase enormously at the root. At a touch, the bulb scatters broadcast a score of small rice-like offsets, and the parent remains so sadly denuded that it must need some time to get into flowering condition again. It is just the same maddening habit as that exhibited by *Iris Danfordiae*.—C. Beck.

Some Forms of *Fritillaria oranensis*.—The accompanying photographs are of interest in showing how great a difference there is between certain forms of so-called *F. oranensis*. No 1. is a plant which I have had for many years, and is chiefly remarkable for the vivid green median band down the middle of each mahogany petal, both within and without. The plant has a slender, graceful appearance, with its narrow, well-spaced, and somewhat drooping leaves.

In No. 2, which shows a potful of bulbs sent back from Morocco by Mr. E. K. BALLS in 1936, we see a much sturdier growth, with broader, blunter leaves, rather inclined to curl. The flowers, as will be seen, vary greatly, and show much more green than mahogany in two, whereas the third has only a suspicion of green on it.

The bulbs of each type are almost identical, but I have not been able to compare the seed capsules, as neither of them has, as yet, set any seed.—C. Beck.

The Origin of the Name *Lilium pomponium*: a Suggestion.—How the Lily described by BAUHIN as *L. rubrum angustifolium* came to be known as *L. pomponium* may be reckoned, I suppose, one of the minor mysteries of liriology. To say that LINNAEUS published the name in his *Species Plantarum* [Ed. 1, 302 (1753)] leads us nowhere. Where did he get the word *pomponium* from? He extracted it, one presumes, from the common currency of the time, for something like it had been in circulation some 150 years before his book was given to the world.

To Mr. S. SAVAGE, Librarian of the Linnean Society, who, amidst a multitude of duties finds time to explore the byways of botanical history, I owe the information that the first appearance of a related word as a Lily name occurs in the *Curae posteriores* of Clusius (1611) edited by Everard Vorstius. The work contains an appendix to Clusius's *Rariorum plantarum historia*, and in this appendix there is a description of *Martagon Pomponii* together with a comment that those who grow the plant say they received it from Italy under that name. It is impossible to find the origin of this Italian usage, but the employment of what is apparently the genitive singular in the specific name suggests its derivation from that of either a person or a place. The first possibility, that the designation was intended to honour one of the many long-dead Pomponiuses, is too remote for serious consideration, but that the word was meant to indicate a place is at least credible.

Credible enough, indeed, to impress more than one author of the seventeenth and eighteenth centuries. PARKINSON, for instance, speaks of the "Martagon of Pompony" [Paradisi in Sole, 2nd imp., 34 (1656)] and PHILIP MILLER, in his Gardeners' Dictionary [Ed. 4 (1754)], of the "Red Martagon of Pompony."

A fairly comprehensive scrutiny of ancient and pre-modern maps and geographies by my friend Mr. HILTON STOWELL, who is learned in such matters, has, however, failed to discover any such place as Pompony or, indeed, any place-name which might be so construed. We may be satisfied, in short, that Pompony never existed.

To what, then, does *pomponium* owe its derivation? A word "pompon" is used both in this country and the continent to mean a tuft, tassel or other soft, rounded object used for personal or domestic ornamentation and there is a distinct resemblance between such a thing and a Lily of Martagon type. Nevertheless, as "pompon" is of uncertain etymology and unknown age, one hesitates to regard it as the parent of "*pomponium*."

But there is another "*pompon*" (or *popon* or *poupon*) an Old French word meaning a melon or melon-like fruit (*cf.* Ital. *popone*, English *pumpkin* and earlier *pumpion*), derived from the Latin *pepo* and Greek *pepon*, and I suggest it was from this that *L. pomponium* has its name. It requires no great effort of imagination to see a likeness

between the flower of the Lily and a Melon of the ribbed or Canteloup kind, a fruit with which French and Italian gardeners of the 16th and 17th centuries must have been very familiar.

We may be sure that LINNAEUS had no thought of geographical derivation in giving *L. pomponium* its valid name for, associated with his description of the plant are the words "*Habitat in Pyrenaeis, Siberia.*" An erroneous observation, it is true, but one without a hint of Pompony.

KER-GAWLER, too, would have none of it. In the Botanical Magazine for 1805 and 1807, under tab. 784 and 971, he gave Pomponie Lily and Scarlet Pomponium Lily as the common names of the species, and hoped, no doubt, to bury the fabled Pompony in the dust of the past.—*Fred Stoker*.

Lilium Davidi or Lilium Davidii?—This is a question often asked, and since both spellings occur in standard works it is a very natural one. The International Rules give guidance, but the rule (Art. 70) governing the question can hardly be considered entirely satisfactory.

According to the Rules the precise original spelling of a name or epithet must be retained except in the case of a typographical error or a clearly unintentional orthographic error. In botanical literature the genitive singular of a personal name may be found spelt "i," or "ii," the particular spelling depending partly on the custom prevailing at the time. In order to ascertain the correct spelling of a name under International Rules it is, therefore, necessary to consult the work in which the name was originally published, a procedure which is only possible in a large botanical library. The tax imposed on the memory by attempting to recollect the original spelling of the hundreds of personal names is intolerable.

With a view to securing uniformity in the case of these names it is understood that a proposal will be put forward at the next International Botanical Congress (1940) to enable botanists to adopt a uniform ending, either "i" or "ii," irrespective of the original spelling. As it is not certain, however, whether such a resolution will be carried it is advisable to follow the existing rule.

The original spelling used by FRANCHET for Père DAVID's Lily was *Lilium Davidi*.—*A. D. Cotton*.

Lilium giganteum × L. pardalinum.—I should like to place on record an effort I made a few years ago, a perfectly lunatic attempt, and the possibilities of it are still almost incredible to me.

I very carefully segregated a flower of *L. giganteum*. The anthers were removed long before the pollen shed, and I then pollinated it in the presence of an enthusiastic friend with *L. pardalinum*, never hoping for any results. It did, however, produce a pod containing 11 seeds and different from any other pod on the stem, and even the seeds looked unlike *L. giganteum*. They were sown by me in a par-

and five of them germinated. In the second year the little bulbs were transplanted into another pan and these were quite unlike *giganteum* bulbs, of which a quantity had been sown at the same time. Two of them never appeared again, but three made little round bulbs about the size of a filbert. Then, when they were dormant again, an old gardener who was tidying up concluded that there was nothing in the pan and emptied it. I showed the bulbs to Mr. CONSTABLE on one occasion, and he remarked that they looked nothing like *giganteum* bulbs, and my friend who was with me at the time still declares it was a successful cross, although I must say I think it is scarcely believable and I should have written it off as having been accidentally pollinated if I were not certain that it had been protected long before the stigma was receptive and for a considerable time after the seed pod had formed.

I do not believe any Lily growers will ever believe this unless they try it for themselves.—Geo. Dillistone.

Lilies in Canada in 1937.—F. L. SKINNER of the Manitoba Hardy Plant Nursery, Dropmore, Manitoba, writes to Colonel NAPIER:—“The past season has been a little disappointing here in respect to Lilies; on the night of June 8 we had the worst summer frost I have seen. The young growths of Butternuts, Walnuts, Spruce, and even Virginia Creeper were completely blackened, and many Lilies, including the *umbellatum* group, *tenuifolium*, the *Martagon-Hansonii* and my *philadelphicum* hybrids, that were grown in the open nursery lost all their flowers, so that I have had to put off for another year the final selection and introduction of these varieties. Fortunately, however, a few beds near the buildings escaped injury, and I had *L. dauricum luteum* flower for the first time and three bulbs of *L. philadelphicum luteum* also flowered. I crossed these both ways in the hope of getting an easy Lily with the lovely form and colour of *L. philadelphicum luteum*. I also used the pollen of *L. philadelphicum luteum* on *Willmottiae* and several others.

“We had over a hundred stems of *L. Davidi unicolor* flower and I worked on over two-thirds of them with the result that one pod ripened a few seeds. Though this sounds very disappointing, still I have found that I very often have the best results when only one or two plants result from a cross.

“There is very little to report in the way of new hybrids for this year; a *tenuifolium* hybrid of distinct habit and form did flower, but was so badly damaged by frost that I can't say much about its colour. In habit it is very stiff and upright with leaves from a quarter to one-third of an inch in width and three to four inches long. The bulb has few large fleshy white scales like *tenuifolium*, but with thick contractile roots. If the colour is good I think it will be rather a nice thing, and as I succeeded in getting a few small bulbs from scales one will be sent to you as soon as possible.”

The Treatment of Imported Lily Bulbs.—Although there may be nothing new in this method of dealing with the dried up bulbs which one occasionally receives from the East, the idea suggested itself to me when I received a dozen *L. ochraceum* late last Spring ; the scales were much shrivelled and some were decayed—roots, of course, were absent. After cleaning off damaged scales with a sharp knife the bulbs were each bedded down in one of my “sand-boxes,” which every gardener has for the propagation of cuttings—a mere sprinkling of sand was placed over the bulbs and the glass top closed down. From time to time I took the bulbs out, examining them for the formation of roots, and, if necessary, removed any further signs of decay.

The plumping up of the scales showed that the bulbs appreciated the close moist atmosphere of the frame, and it was not until each basal plate showed signs of three or four young roots that I planted the bulbs in the growing compost. Although very late in flowering, all have done extremely well, and I am still cutting the blooms for house decoration in mid-December. These are, of course, in a cool house ; three bulbs planted out in a south border did equally well, but were overtaken by a sharp frost when in full bud and killed back, together with the stems of all the other Lilies. I contend in favour of this method of treatment that one need not worry as to over- or under-watering of the dormant and sickly bulbs, which is always the case when they are potted up straight away, and further, that no mildew forms about the scales—which can be cleaned and scraped up to the moment of potting, by which time the bulbs are practically in full growth.—*Maurice Amsler.*

Lilium Davidi unicolor.—With regard to the *L. Davidi unicolor* flowers being spotted or not, I was much amused to-day to notice on carefully looking over our Lilies just returned from Chelsea Show that not only did the flowers on different plants vary considerably as to whether they were spotted or not, but that the variation was to be observed on the one plant. The only cause that I could surmise was the condition of the plant just before the individual flower opened, a check or poor growth causing fewer spots. I do not think there is any doubt that the cultivated plant is all one clon, though I have since raised an unspotted seedling.—*H. F. Comber.*

Precocious Development from Scales.—I noticed that in the report of the Lily Group's discussion on the Propagation of Lilies from Scales (see p. 43 of the Lily Year-Book 1937) someone said that they had a Lily bloom from scales in two or three years. This year in July a plant of *L. × "Lillian Cummings"* bloomed when less than a year old. In August, 1936, we put scales of various Lilies in a frame outdoors in peat and sand. Some formed bulbets in a few weeks and one or two "Lillian Cummings" bloomed in July, 1937. We covered the frame with leaves for the winter. This is a most prolific Lily here and grows very rapidly from scales.—*Isabella Preston, Ottawa.*

Hybridizing of *Lilium longiflorum*.—The varieties of *L. longiflorum*, the common Easter Lily, differ in morphological characters such as colour of stem, shape or leaf, size and texture of flower, and in physiological characters such as earliness or lateness of flowering, hardiness, and tolerance of storage at low temperatures. For example, the Bermuda Easter Lily (*L. longiflorum eximium*, the florist's "Harrisii") has green stems, flowers very early, and has large blooms of a most delicate texture and bulbs which will not tolerate cold storage, whereas the Japanese Easter Lily (var. *takesima*, the florist's "giganteum") has dark-red stems, is later in flowering, and has smaller blooms of a much firmer texture, and bulbs which will stand up fairly well to cold storage. Such characters are important since the purchaser will in the normal course of events buy the Lily possessing the properties which he requires.

These varieties, and other varieties of this species differing in other respects, retain their distinctive characters through being propagated vegetatively by scaling of the bulbs. As soon as propagation by seeds is employed a wide variety of form is obtained, no matter whether the parent-plant is selfed or is cross-pollinated. Accordingly, in searching for an improved form, the investigator can either look for the combination of characters he requires amongst the seedlings from a naturally-pollinated plant, or preferably he can make deliberate cross-pollinations between parent-varieties which possess the chief qualities which he wishes to combine.

Since 1934 seedlings have been grown in the Department of Agriculture, Bermuda, from naturally pollinated and from artificially pollinated plants of several varieties. Some difficulty has been caused from the fact that even when pollinated by hand the Bermuda variety sets seed rarely.

In the case of an artificial pollination a bud which is due to open in about two days time is chosen, the perianth segments are unfolded and the immature anthers are carefully picked off. The bud is then closed by replacing the perianth segments which are bound near the tip with a rubber band. Two or three days later, if pollen from the plant chosen as the male parent is ready, the flower is opened and the stigmas, which are by this time receptive, are well dusted with pollen. The perianth segments are then bound together again with a rubber band, which is left in place till the perianth and style have withered. The immature stamens if they are to be used for pollinating another plant are placed in a stoppered glass phial where they can be safely stored for several days at room temperature and will gradually ripen.

This work done on varieties of *L. longiflorum* is not sufficiently advanced to make more than preliminary observations possible. The majority of seedlings flower in eighteen months from the time of sowing, but a few blooms were obtained in June, 1937, from seed which was ripened in the summer of 1936 and sown in the open on October 1, 1936.

In general it appears that the progeny of a red-stemmed parent crossed with a green-stemmed parent is red-stemmed, while an early-flowering variety crossed with a late-flowering one gives varieties tending to be intermediate in date of flowering.—*T. A. Russell, Director of Agriculture, Bermuda.*

Precoicity of *Lilium formosanum* (Wilson's form).—In February, 1935, I sowed a large boxful of seed of *L. formosanum* Price's variety, now listed as var. *Pricei*. The seed was of commercial origin and came up at once, many of the young plants were given away by the hundred and those I kept were either potted up—five or six in a six-inch pot—or else pricked out in a nursery bed; a number of small bulbs left over from the above were dumped in a lump in a brick frame containing deep and rather rich soil. The potted plants were wintered in a cold greenhouse and transferred to the rock garden last summer, when they flowered in August—mostly being about 2 ft. 6 in. high and bearing one, two or three typical flowers. The bulbs which had been pricked out flowered rather later and less vigorously, but those which were crowded together in the brick frame did not make much growth, nor did any flower, with one exception—and this particular plant is the subject of this note.

It was obvious quite early in the season that one individual of this bunch was going to flower, as it had shot up to a good height, and when in full growth it was lifted and potted—the bulb was much larger than any of its neighbours and had a large central stem and two lesser side shoots. The shift seemed to disturb it very little, if at all, and in September the plant flowered at about 5 ft. 9 in. The central stem had six perfect blooms and the laterals three each, equally good. The plant was evidently the typical Wilson form, and not the dwarf var. *Pricei*.

Truly when unaffected by virus this is one of the most beautiful of Lilies, and if one could always be certain of flowering the plant in 18 months it would be best to rely entirely on seminal propagation, treat it as a biennial and not keep the old bulbs which are so often diseased and produce deformed flowers.

By raising seed in slight heat, say in January, it is clear from my experience that it should be possible to induce the bulbs to flower the following year and well before the autumn frosts, and in exceptional cases some might even flower the same year.

How this one specimen of WILSON'S plant came up among many specimens of var. *Pricei* will always be a mystery.

It will, of course, be suggested that stray seed of WILSON'S Lily was inadvertently included in the packet of *L. formosanum* var. *Pricei*, but the small nurseryman from whom I obtained my seed had only the latter variety to my certain knowledge—in fact, the seed was obtained from plants of *L. formosanum* var. *Pricei* which I had myself given him in the past.

It has been suggested that the subject of this note may have been a mutant, or possibly a case of reversion to type.—*M. Amsler.*

Lilium myriophyllum superbum : damage to buds by wasps.—A large imported bulb, potted last March in a 16in. cylindrical pot, was grown entirely out of doors until the beginning of September, when it was removed for flowering to a greenhouse. Upper growth did not appear until June 17, but when brought into the house it had three great 6ft. stems, one carrying three, and the others two buds each. The buds were three or four inches long, and by September 10 were growing rapidly in length and showing some colour. About this time I noticed that wasps and, for that matter, mosquitoes and flies, were attracted to the buds. I was mildly interested, as Lilies growing alongside, e.g. *L. ligrinum Fortunei*, *L. Henryi* and others received no attention. It was soon evident that the wasps were feeding on the buds, as examination showed a tiny puncture after each visit, and mosquitoes could be observed motionless for over half a minute with proboscis deeply buried in the tissues of the bud. Ordinary flies were also busy on the same area of the buds and were, no doubt, feeding on the juices oozing from the punctures made by the wasps. Bees were numerous in the greenhouse, but did not visit the buds. The wasps and mosquitoes confined their attentions to the distal third of the outer segments of the buds, and more particularly to the portion $\frac{1}{2}$ in. to $1\frac{1}{2}$ in. from the tip. The punctures were mainly in the central vein of the outer segments, to lesser extent in the lateral veins. The inner segments of the buds were only slightly attacked along the central vein in the distal portion of the middle third where exposed between the outer segments. It is a feature of this noble Lily that the buds elongate markedly for some days before opening. You see a bud showing full colour and six or seven inches long, and you conclude it will open tomorrow. But it continues growing to eight, to nine or more inches before it deigns to unfold its beauty. I gave my Lily some protection with gauze for about a week before the buds opened—the first on September 21. I did so because I saw that the wasp punctures were becoming discoloured, and elongated into dark, linear scars, the longest perhaps $\frac{1}{6}$ in. to $\frac{1}{8}$ in., mostly along veins. By the time the buds opened these marks appeared as black chains for a couple of inches from the tip along the central vein, or as scattered rows along the lateral veins in the same area. They would have ruined the appearance of the blooms were it not that they were largely concealed from view within the perfect curl, so characteristic of the outer segments of this flower. Neither wasps nor mosquitoes attempted to damage the open flower which, however, in the late bud stages appears to have attractions for them not usually possessed by Lilies.—*P. J. Dwyer (Lt.-Colonel), Stillorgan, Co. Dublin.*

Growth of the Lily Bud.—During the course of the observations last season of the damage done by wasps to buds of *L. myriophyllum*

superbum I found that the incisions, originally more or less circular, appeared to lengthen with the growth of the bud, and finally appeared as a series of somewhat linear discoloured scars, mainly situated towards the tips of the tepals. I assumed, not unnaturally, that the growth of the bud was, in the main, responsible for the apparent elongation of the bite marks. If, however, this explanation were correct it would mean that growth should occur chiefly about the tip of the bud, which was the part mainly attacked. I did not know, or only guessed at the mode of elongation of a Lily bud, and a search through the technical literature available to me failed to throw any light on the question as to how a Lily bud grows.

When the plants came into bud somewhat early this year an opportunity was taken of solving a problem not without interest. I selected buds to work on, as I thought that a bud which elongates so markedly, especially in the week prior to opening, would allow me to make reasonably accurate observations. I made marks on the buds at various stages of growth ; marks which, while fast, would not interfere with development.

With the growth of the bud the changes in the relative positions of the marks were to me entirely unexpected. The changes which resulted broadly show that the bud elongates chiefly as a result of growth in the proximal third. There is much less growth in the middle third, and very little in the terminal portion of the bud.

I am continuing observations on the growth of other Lily buds, and find so far that the same general mode of elongation holds good for buds such as those of *L. Henryi* and *L. tigrinum*. It appears likely that all Lily buds lengthen in much the same way, but further observation is necessary. It is hoped to extend these experiments to buds of allied genera, and eventually to determine whether there is not a fundamental difference in the mode of elongation of flower buds of monocotyledonous, as contrasted with those of dicotyledonous plants.—P. J. Dwyer, Dublin.

Hybrids of *L. chalcedonicum maculatum* × *L. candidum*.—Mr. FRANK JONES of Lechlade made this cross some years ago. He kindly sent me a few seedlings of this cross. Some of the seedlings flowered on July 24 this year. They may be divided into three categories—

(1). These seedlings had flowers after the shape of *L. chalcedonicum* but are of a lighter shade of red and had larger flowers, and the leaves and way of growth more after the style of *L. × testaceum*. The strongest plant had four flowering spikes, the tallest 5½ inches high, with four flowers and two other spikes had three flowers each and one two-flowers. These Lilies were indistinguishable from *L. × Beerensii*, which is a hybrid of *L. chalcedonicum* × *L. × testaceum*.

(2.) One seedling had flowers of a wonderful deep salmon apricot colour, and the flowers were more of the shape of *L. × testaceum*, only somewhat smaller. The anthers were deep scarlet. It was 3½ inches

high, with two spikes with four flowers on one spike and three on the other. This plant has been named by Mr. JONES *L. × 'Sybil Stern.'* (3.). One seedling had only one flower, which was after the shape of *L. chalcedonicum* but of a clear yellow colour.—*F. C. Stern.*

Lilium Wardii (fig. 19).—The bulbs were planted in 1934 in a position that did not seem to suit them, and when lifted in October, 1935, there were eight bulbs in all. Four were medium-size, probably not more than 1 inch in diameter, while the other four were about the size of a small walrus. They were planted in two groups according to the sizes and in a bed with a heavy clay subsoil. An addition of peat, sand and leafmould was dug in and the bulbs planted about 4 inches below the surface and bedded in sharp river grit. In 1936 the larger bulbs flowered, giving a few flowers to each stem. The position is half shaded and behind a planting of *Pittosporum tenuifolium* with a big Scots Pine close by and I am pretty sure the roots of both are right through this bed. This may be all right in a winter like 1936-37, when these roots may have absorbed some of the excess moisture, but in a dry spell they rob other plants of all moisture as well as food. Nothing further was done to the Lilies except a dressing of Lomux Lily Food was given and watered in during June. The results were surprising, but whether it was the result of the food or whether they liked the soil in which they were growing, I cannot say. I certainly do not expect to see them as good next year. I was greatly surprised to see them so good this year.—*G. H. Dalrymple, 1937.*

Lilium sempervireoides flowered at Bodnant this spring, it is believed for the first time in cultivation. A few bulbs were collected by some Chinese collectors working for me, but they travelled badly, and very few survived.

Some seeds said to be of this species were also sent. They germinated slowly, but there is now a good pan of them.

It is not yet, however, possible to say whether the seeds are true, but they look in foliage very like the plant that has flowered.

The flower and the plant were sent to Kew to be figured for the Botanical Magazine.—*Lord Aberconway, Bodnant.*

Lilium candidum.—In the spring two years ago my gardener, Mr. IZZARD, found some bulbs of *L. candidum* unplanted. He put them into the ground and they flowered. No new leaves appeared in August. They came up in the following spring. Once again no new leaves appeared that August, and once again they existed till the following spring, the spring of this year. In August I asked him whether the leaves had come up, and he said that none had appeared as yet, but that as the ground had been so very dry it was perhaps too early to say definitely that they would not come up this autumn. Has anyone else had such an experience? If Madonna Lilies could be trained not to push their leaves till spring it would be a great help towards

curing them of Botrytis. [Later. These Lilies began to grow leaves about the end of September.]—*Canon Rollo Meyer, Little Gaddesden.*

Lilium regale, etc.—When I was rector of Watton-at-Stone I planted three bulbs of *L. regale* (which I had grown from seed) in the School gardens. They flowered well the first year and better the second. The third year spring frosts crippled them, but the following year one of them grew over 7 feet high and had 35 flowers. Does *L. regale* often grow over 7 feet high?

Experts tell us that sometimes stem-rooting Lilies have no stem-roots. Is it well-known that some Lilies that are not supposed to be stem-rooting do form stem roots on occasion? I lifted a fine *L. × testaceum* the other day, and it had quite a lot of stem-roots.—*Canon Rollo Meyer, Little Gaddesden.*

Lilium ochraceum in Ireland.—A deep lemon form of *L. ochraceum* has flowered at Mount Stewart this season. It was raised from FORREST's seed (No. 29044, 19th sending) which I am told was collected in Upper Burma and is now being grown in several other gardens.

The seed was sown under glass in pots, and the resultant seedlings planted out in a cold frame in gritty soil. They were afterwards transferred to the open woodland and planted in the natural loamy soil. The bulbs are still very small, and up to the present the thin, wiry stems reach no great height. When the plants are older we hope they will grow taller and produce more flower buds.

The Lily has presented no difficulty in cultivation, which may encourage others to try it. It flowers with us about mid-July. The flowers of my form are rather small, of a deep lemon yellow colour and show less than usual of the purple markings in the throat. They have a delightful scent, which is most pronounced in the evening, reminding one almost of orange blossoms.—*Marchioness of Londonderry, Mount Stewart, Co. Down.*

Lilium × aurelianense and its Offspring in 1938.—On page 101 of the Lily Year-Book, 1936, M. EDOUARD DEBRAS, the raiser of *L. × aurelianense* (*L. Sargentiae* × *L. Henryi*) wrote "The crossing of *L. × aurelianense* by the pollen of *L. Henryi* has given me a fairly large number of vigorous hybrids which began to flower in 1936. . . . They are of no particular interest and probably are not worth keeping."

On August 4th, 1938, M. DEBRAS sent to the Secretary of the Lily Committee eight buds of these hybrids, together with one of *L. × aurelianense* for comparison, saying "Contrary to my first impression these hybrids of *aurelianense* ♀ × *Henryi* ♂ appear to be rather interesting, but some selection will be necessary to eliminate the inferior forms. . . . In foliage and habit they are almost exactly like *L. Henryi*; some specimens have a stiff stem, but others have inherited the habit of *Henryi*, which is inconvenient and necessitates

staking. The flowers are generally more open than those of *aurelianense* and are very varied in colour. . . . The inflorescence is usually of the *Henryi* type, the lower branches being two- or three-flowered."

The buds opened nicely in water and were exhibited at the Fort-nightly Show on August 9 and 10, where they attracted a good deal of attention. The hybrids appeared to fall into three groups. Two flowers were what M. DEBRAS calls "bicolors," not unlike *aurelianense*, the lower half of each segment being orange-yellow with orange-yellow papillae, and the upper half creamy white. Three flowers were practically self-coloured, being either buff-yellow, or orange-yellow, with reddish brown papillae; the remaining three flowers had conspicuous orange-red papillae on buff-yellow segments, giving the impression that the segments themselves were orange-red.

Lilium chalcedonicum × L. chalcedonicum maculatum.—In making this cross I chose the spotted form as the seed parent because it flowers a week later than the type, which I think is very important, for the pollen bearer should be at its best and the seed bearer being the younger flower, will take the pollen more readily.

The cross was made in 1933 and I gathered the seed in October. I sowed it the same month on a three-yard border of my garden facing west, with an eight-foot wall behind it. The seed germinated the following spring and nearly all grew on, and the seedlings were allowed to remain in the bed until 1936. They were transplanted in 1937 and twelve flowered, three having two, and the rest one flower each.

They nearly all flowered in 1938, more than two hundred, and all had good flowers. There were about forty *L. chalcedonicum* without spots, and one had two stems with six flowers on each—a real beauty, strong and vigorous and much better than the pollen parent. The others had from one to eight flowers on a stem. Of the remainder fully half (over eighty) were *L. chalcedonicum maculatum*, with jet black spots and some of these had as many as seven flowers on strong stems. The others had spots of a lighter shade varying from black to the self-colour of the Lily and very pretty they were.—J. R. Smith, Methley, Leeds.

Lilium × Coronation (fig. 13, facing p. 45).—This Lily is an open fertilized seedling of L. 29.01.07, which was an unnamed sister seedling of Grace Marshall (Lily Year-Book 1936). The parents of which were *L. Davidi Willmottiae* and an unnamed *dauricum* seedling. The seed was sown in January, 1933, and the plant had three blooms in July, 1934, and seventeen in 1935. The frost on May 16, 1936, damaged the plants severely and the bloom was poor and the stems distorted that year. In August the bulbs were divided and transplanted. There were four large and forty-seven small bulbs in all. Three of the large bulbs divided and the flower stems carried seventeen to twenty-one blooms and even some of the small ones bloomed in July, 1937.

For some reason the scales we removed did not do well, although they were treated in the same way as scales from Grace Marshall and Lillian Cummings, which did splendidly. The winter of 1936-7 was very difficult for many hardy plants, and I hope that another season *L. × Coronation* will be taller and carry more bloom.

Several Lily enthusiasts from the United States who saw it agree with me that the colour is uncommon among easily grown Lilies.

A short description follows:—

L. × Coronation (L. 32.10.01), height 3 ft., stem green speckled brown; leaves many, lower 5 ins. long, $\frac{1}{4}$ in. wide, acute, base not narrowed, upper leaves shorter $2\frac{3}{4}$ ins. long, $\frac{3}{8}$ in. wide, margins revolute, cerro green; flower $2\frac{5}{8}$ ins. wide, segments strongly reflexed colour Primuline yellow with small, brown spots. Filaments and style clear dull green yellow, pollen Kaiser brown. The outside of the segments is pale yellow, so that the general effect is all the same colour, although the flowers droop more than is desirable. No. 1 shows the inflorescence of one plant and No. 2 a single flower, natural size.—*Isabella Preston, Central Exptl. Farm, Ottawa.*

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* Died, Sept. 23, 1938.

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